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Selection of Transient Cycles for Heavy-Duty Engines

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Technical Support Report for Regulatory Action

(INTERIM REPORT)

Selection of Transient Cycles for Heavy-Duty Engines

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and
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November 1977

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This report presents summary statistics of those candidate cycles generated by computer to be representative of the CAPE-21 data base and selects one cycle for each category that is most representative. The selections are based solely upon statistical considerations. Further evaluations of the candidate cycles must still be made in terms of the practical aspects of running the cycles on the dynamometer, and in terms of the physical representativenesss of real operation. The cycles identified are being used by EPA as a basis for developing its test facilities. This report if being released in response to numerous requests by organizations considering the development of transient test facilities to give an indication of the types of cycles that are expected to be used in future certification procedures. This report has been labelled as an interim report to emphasize the tentative nature of the selected cycles. EPA plans further evaluation of the cycles.

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Foreword

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This report has been labelled as an "interim" report to emphasize the tenative nature of the selected cycles. As indicated above, EPA plans further evaluation of the cycles. Along these lines, one problem has already been identified with the New York non-freeway cycle for gasoline engines. It has been shown that this cycle has excessive high speed (RPM) operation. The problem has been attributed to one truck contributing bad data to the input data base rather chan to the computer cycle generation procedure. An addendum has been attached to this report which addresses this specific problem and provides a recommended solution. EPA has not made a final determination regarding this "problem" cycle.

Selection of Transient Cycles for Heavy-Duty Engines

Summary

As a product of the heavy-duty engine cycle development effort, computer-generated engine cycles have been provided by Olson Labs. Out of three candidate cycles in each of 8 truck categories, one cycle from each category was chosen as the most representative of the actual truck data. Using the cycle's summary statistics calculated by Olson and the power and RPM density functions, the cycles in each category were scored. Table 1 lists the selected five-minute cycles by their designated random numbers. A second-by-second listing for each of these selected cycles is included in Appendix B.

Table 1

Category			Cycle
LA	Gas	Non-Freeway	203887989
	Gas	Freeway	296644805
	Diesel	Non-Freeway	2110248101
	Diesel	Freeway	1599345415
NY	Gas	Non-Freeway	8410263
	Gas	Freeway	792043535
	Diesel	Non-Freeway	2114147447
	Diesel	Freeway	104099549

Background and Introduction

Since the CAPE-21 truck-usage data has become available, there has been an effort to generate computer cycles which simulate the real-life driving patterns. CAPE-21 refers to an EPA project which was conducted as a means of acquiring an accurate picture of actual urban truck operation. In each of the cities of Los Angeles and New York, forty-four in use trucks (plus 3 buses in Los Angeles and 4 in New York) were instrumented to record vehicle and engine data on an approximately second-by-second basis. The parameters of interest were vehicle speed, engine speed, road and traffic conditions, and a load parameter (i.e., a measure of power, such as manifold vacuum or rack position). With this compiled information as a basis, an attempt has been made to synthesize -- via computer -- cycles of relatively short duration which simulate the operating characteristics of the total real-life sample. The intent is to make possible in-lab testing which is indeed representative of on-the-road operation.

Olson Laboratories has provided candidate cycles -- both chassis and engine cycles -- produced from the New York and Los Angeles data. The selection of the engine cycles is the concern of this particular report.

Twenty-four computer-generated 5-minute engine cycles were provided, three in each of the following eight road categories:

Los Angeles	Gas	Non-Freeway
	Gas	Freeway
	Diesel	Non-Freeway
	Diesel	Freeway
New York	Gas	Non-Freeway
	Gas	Freeway
	Diesel	Non-Freeway
	Diesel	Freeway

Although numerous cycles were generated, only a few passed the screening criteria developed by Malcolm Smith of Olson. He selected from these the best three in each category and submitted them as the candidate cycles. It was necessary for EPA to choose one candidate cycle for each category.

The primary way by which the cycles were compared and rated was with the Kolgomorov-Smirnov one-sample test, hereafter abbreviated "K-S test". The K-S test is a non-parametric statistical test concerned with the degree of agreement between two distributions. It determines whether two distributions can reasonably be thought to have come from the same population. Specifically, the candidate cycle cumulative distributions are compared to the CAPE-21 cumulative distribution (assumed to be the theoretical distributions). When compared on an increment-by-increment basis, there will occur at some point a maximum difference D between the two distributions. D can be related to a level of significance, α, which depends on the size of the sample. If the maximum difference D exceeds the critical difference for that sample size at a particular significance level (α), then the sample does not pass the K-S test and it must be assumed that the two distributions are dissimilar. Table 2 relates sample size to significance levels and critical differences.

Table 2*

	Significance Level α				
Sample Size (N)	.20	.15	.10	.05	.01
Over 35	$\frac{1.07}{\sqrt{N}}$	$\frac{1.14}{\sqrt{N}}$	$\frac{1.22}{\sqrt{N}}$	$\frac{1.36}{\sqrt{N}}$	$\frac{1.63}{\sqrt{N}}$

The computed values are the critical differences for a particular N. The smallest critical difference which exceeds the maximum difference D for the test yields the significance level.

* from Nonparametric Statistics, Sidney Siegel, McGraw-Hill, NY, 1956.

In digression, the significance level is the probability of rejecting a true hypothesis when it is actually true. In relation to the K-S test, significance level is the probability of not accepting two distributions as being the same, when in reality they are. This type of error is acceptable when comparing two cumulative distributions. Therefore, it is desirable to have a large significance level, since this results in more assurance that the two distributions being compared are really the same. For most engineering and statistical applications, significance levels of .05 or .10 are adequate.

Each cycle was compared with the input data in two ways by means of K-S tests (as detailed below). In this manner the acceptability of the particular cycle could be rated.

Selection Procedure

The procedure for selecting a best of the three candidates in each truck category involved ranking the cycles according to three main criteria: 1) The overall summary statistics for each cycle, 2) the agreement of the distribution functions (for power and RPM) with the input data, as screened by the K-S test, and 3) a visual rating of the density plots. In most cases a clear choice for each category could be made according to these criteria.

A table of Summary Statistics was provided by Olson for each candidate cycle; they reflect several ways in which the cycle parameters were compared to those of the input. Olson was able to compile the massive road data into a matrix relating observed initial and final values for both engine speed and power. It is from this matrix that the numerous cycles were generated (out of which the three best cycles in each category were "filtered"). The cycles themselves were, for testing purposes, converted to initial/final RPM and power matrices, and various portions of the matrix were tested for similarity with the corresponding portions of the input matrix.

The screening test was accomplished by arranging the rows of several sectors of both the cycle matrix and the input matrix into cumulative distribution functions. The K-S test as described above could then be applied to the distributions, and the summary statistics present the significance levels at which the cycle passed (or failed). Table 3 shows that tests were done on the matrix as a whole, on the diagonal of the matrix, and on the upper and lower portions (above and below the diagonal).

It can also be seen from Table 3 that several other parameters were tabulated in the statistics -- for the input as well as for each candidate cycle. The fraction of occurrence which the cycle matrix exhibits in the upper, lower, diagonal (less idle), and idle (RPM and power <u>both</u> equal zero) portions are tabulated in the "CYCLE PERCENTAGES" column of Table 3. Also, the percentages of the cycle that the engine speed or

TABLE 3

LA	Significance Level M	D	U	L	Cycle Percentages U	L	D	Idle	Mean RPM	RPM Percentages A	D	C	Z	Mean Power	Power Percentages A	D	C	M	Z
GAS Input					31	28	16	25	26	25	22	24	29	31	16	18	24	14	29
NON 85063489	.14	.22	.20	.47	35	24	18	23	27	31	18	26	25	38	16	19	36	6	24
FWY 2038877989	.15	.74	.94	.32	31	29	14	26	27	27	23	22	29	33	15	18	29	11	27
2113161687	.11	.45	.83	.93	28	28	16	29	24	21	21	23	36	32	16	18	23	14	29
GAS Input					29	29	40	2	63	19	18	60	3	63	17	18	55	7	3
FWY 1256706477	.01	.15	.01	.15	30	30	38	2	61	24	23	51	2	75	15	15	59	8	4
1223400511	.01	.01	.20	.05	32	28	38	2	64	23	19	57	2	67	21	18	49	8	3
296644805	.20	.15	.20	.20	28	28	41	2	64	22	16	60	2	68	14	18	59	7	2
DSL Input					30	26	10	35	43	26	22	14	38	22	14	15	13	22	35
NON 2110248101	.80	1.0	.55	.22	28	29	10	34	43	26	24	13	37	26	12	14	18	21	34
FWY 2124416999	.13	.39	.50	.13	29	29	10	31	45	27	27	13	33	21	13	14	12	31	31
279615	.10	.93	.26	.39	28	28	9	34	45	25	27	14	35	20	15	15	16	21	34
DSL Input					36	35	27	2	84	26	24	48	2	54	22	22	38	16	3
FWY 1599345415	.43	.17	.76	.59	37	36	24	2.3	83	27	25	46	2	56	22	23	41	12	3
1109958927	.14	.15	.75	.56	34	29	35	2.2	83	25	26	48	2	64	20	18	44	15	3
1041454501	.16	.38	.42	.58	37	26	35	2.3	82	26	28	44	3	51	22	18	42	14	3
NY																			
GAS Input					23	23	14	40	13	18	17	17	47	19	14	14	14	16	42
NON 8410263	.41	.72	.35	.65	23	22	12	41	12	19	17	10	54	20	14	16	12	17	42
FWY 2189178847	.13	.67	.12	.61	26	18	9	46	13	20	13	14	53	16	13	15	12	12	48
2140599455	.18	.55	.20	.24	20	21	10	49	13	16	18	14	52	16	11	10	11	17	51
GAS Input					33	31	26	10	48	23	21	45	12	50	19	20	32	18	11
FWY 792043535	.13	.72	.57	.43	33	31	24	12	50	25	17	46	12	48	18	24	31	13	13
229633293	.036	.61	.14	.098	31	37	22	10	50	23	29	38	10	48	19	20	25	25	11
202045271	.087	.21	.59	.27	32	31	26	11	50	28	24	36	11	58	16	17	34	21	11
DSL Input					21	21	7	51	20	17	16	8	58	16	13	12	12	11	51
NON 2114147447	.35	.99	.13	.41	19	21	6	55	20	14	15	8	63	16	12	12	14	8	55
FWY 5618007	.28	.42	.81	.53	19	21	6	53	19	15	17	6	63	14	12	11	10	14	54
2145368549	.18	1.0	.13	.12	23	22	8	48	19	19	17	5	58	19	12	12	15	12	48
DSL Input					32	32	17	19	53	25	25	25	24	42	17	17	26	20	20
FWY 81204277	.15	.16	.06	.15	35	31	12	22	54	28	24	23	25	48	20	20	30	8	23
76964269	.42	.43	.56	.54	31	25	22	22	53	25	20	30	25	50	12	15	29	21	23
104099549	.32	.09	.35	.22	32	31	12	25	52	26	23	23	28	41	18	16	26	14	26

KEY TO TABLES 3 AND 4

K-S Significance Levels:	M	Total Matrix
	D	Matrix Diagonal
	V	Portion Above Diag. (upper)
	L	Portion Below Diag. (lower)
RPM and Power Percentages:	A	Percent Acceleration
	D	Percent Deceleration
	C	Percent Cruise
	Z	Percent Zero
	M	Percent Motoring (power only)

TABLE 4

LA	Significance Level				Cycle Percentages				Mean	RPM Percentages				Mean	Power Percentages					Total	Overall
	M	D	U	L	U	L	D	Idle	RPM	A	D	C	Z	Power	A	D	C	M	Z	Scores	Ranking
GAS 85063489	2	3	3	2	2	3	2	2	1	3	2	2	2	3	1	2	3	3	3	44	3
NON 2038877989	1	1	1	3	1	2	2	1	1	1	1	2	1	2	2	1	2	2	2	29	1
FWY 2113161687	3	2	2	1	3	1	1	3	2	2	1	1	3	1	1	1	1	1	1	31	2
GAS 1256706477	2	1	2	2	1	1	2	1	2	3	3	3	1	3	1	3	1	2	2	44	3
FWY 1223400511	2	2	1	3	2	1	2	1	1	2	1	2	1	1	3	2	2	2	1	41	2
296655805	1	1	1	1	1	1	1	1	1	1	2	1	1	2	2	1	1	1	2	27	1
DSL 2110248101	1	1	1	2	2	2	1	1	1	1	1	2	1	3	2	2	3	1	1	29	1
NON 2124416999	2	3	2	3	1	2	1	2	2	2	2	2	3	1	1	2	1	2	2	36	3
FWY 279615	3	2	3	1	2	1	2	1	2	2	2	1	2	2	1	1	2	1	1	32	2
DSL 1599345415	1	2	1	1	1	1	1	2	1	2	1	2	1	1	1	1	1	3	1	25	1
FWY 1109958927	3	3	2	3	2	2	2	1	1	2	2	1	1	3	2	2	3	1	1	37	2
1091454501	2	1	3	2	1	3	2	2	2	1	3	3	2	2	1	2	2	2	1	37	2
NY																					
GAS 8410263	1	1	1	1	1	1	1	1	2	1	1	2	3	1	1	2	1	1	1	24	1
NON 2109178847	3	2	3	2	2	3	3	2	3	2	3	1	2	3	2	1	1	2	2	42	3
FWY 2140599455	2	3	2	3	2	2	2	3	1	2	2	1	1	2	3	3	2	1	3	40	2
GAS 792043535	1	1	2	1	1	1	2	3	1	2	2	1	1	1	2	3	1	2	2	30	1
FWY 229633293	3	2	3	3	3	2	3	1	1	1	3	2	3	1	1	1	3	3	1	40	3
202045271	2	3	1	2	2	1	1	2	1	3	1	3	2	2	3	2	2	1	1	35	2
DSL 2114147447	1	2	2	2	1	1	2	3	1	2	1	1	2	1	1	1	1	2	2	29	2
NON 5618007	2	3	1	1	1	1	1	1	2	1	1	2	2	2	1	2	1	2	1	28	1
FWY 2145368549	3	1	2	3	1	2	2	2	2	1	1	3	1	3	1	1	2	1	1	33	3
DSL 81204277	3	2	3	3	3	1	1	1	2	3	1	1	1	2	2	3	3	3	1	39	3
FWY 76964269	1	1	1	1	2	2	1	1	1	1	3	2	1	3	3	2	2	1	1	30	1
104099549	2	3	2	2	1	1	1	2	2	2	2	1	2	1	1	1	1	2	2	31	2

power was increasing (ACCEL.), decreasing (DECEL.), remaining constant (CRUISE), or at zero percent of its absolute reference (ZERO) appear under the RPM- and POWER PERCENTAGES. It will be noted that a fifth parameter is included under the POWER PERCENTAGES -- "motoring" occurs when the engine is producing negative power (when coasting downhill against the engine, for example). Finally, the mean RPM and Power are tabulated. The summary statistics, then, present the characteristics of the cycle which the generation process was designed to key upon. It is expected that a reasonable correlation would exist in these areas with respect to the input data (as is indeed the case).

Returning to the selection procedure, the candidates were ranked according to their summary statistics. Table 4 gives the 1-2-3 scoring that was given each cycle for each of the parameters of Table 3 (1 = best, 3 = worst). The highest significance levels were ranked first, whereas the other parameters were compared to input values with the closest match scoring highest. The total scores for the cycles reflect a general ranking within each category; the cycle scoring the fewest points will be favored over the other contenders in this aspect of the selection process, as reflected by the final rankings for each category. This does not necessarily mean the best overall cycle is picked, but certainly some indication of how well the cycle fared with regard to these particular parameters is obtained. This scoring procedure is not flawless -- all parameters are weighted equally, for example -- so a cycle which scores a close second could be easily chosen if other selection criteria favor it.

As a second criterion on which to base the selection of the cycles, a K-S test was performed on the cumulative distribution functions. This was a way of getting a feel for the quality of the RPM and power density functions, considered important because percent operation at, say, full power or at a certain engine speed can dramatically influence emissions. The RPM density functions were plotted in increments of 6% and those for power in increments of 10%*. By summing the frequency percentages incrementally, the cumulative distributions were produced. Then these cycle distributions could be compared increment-by-increment with the respective input distributions (derived for the same increments). The result of this process was a K-S significance level for both the RPM and power distribution functions for each cycle. Hence another means of ranking the three candidiates in each category was provided. Table 5 presents the K-S results and a general scoring within each category; a sample K-S test is included in Appendix A. Again, the higher the significance level the better.

It may be unclear exactly why a cycle can score well on Olson's K-S criteria and yet display a poor density function. One reason is simply that the generation process was not designed to simulate the density function -- just the initial/final matrix. Also, the length of

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* % RPM is defined here as $\frac{\text{RPM - RPM) Idle}}{\text{RPM)rated - RPM)idle}}$.

% Power is the percent of the maximum power at the RPM in question.

Table 5

	Category		Cycle	K-S Significance Level RPM	POWER	Ranking
LA	Gas	Non-Freeway	850-	.20	--	3
			203-	.20	.20	1
			2113-	.10	.20	2
		Freeway	296-	.20	--	2
			125-	.01	--	3
			122-	.01	.01	1
	Diesel	Non-Freeway	2110-	.20	.20	1
			212-	.10	.01	3
			279-	.15	.20	2
		Freeway	159-	.20	.01	2
			109-	.15	.20	1
			110-	.20	--	3
NY	Gas	Non-Freeway	841-	.20	.20	1
			210-	.20	.01	2
			214-	.20	--	3
		Freeway	792-	.15	.10	1
			229-	.01	--	2
			202-	.01	--	2
	Diesel	Non-Freeway	2114-	.20	.20	1
			2145-	.20	.20	1
			561-	.20	.10	2
		Freeway	812-	.20	--	2
			769-	.20	--	2
			104-	.20	.15	1

-- indicates cycle did not pass at .01 level.

the 5-minute cycles is sufficiently short that it is difficult for the computer to sample the entire population (as represented by the input matrix), and this may also affect the frequency of occurrence of various RPM and power values. However, since the generation process tends toward cycles with good mean RPM and power correlation with the input (See Table 3), there is reason to expect that, for the most part, the generated cycles will have reasonable density functions (and this is generally the case).

The third criterion by which the cycles were rated was simply a visual comparison of the power and RPM density plots for the various candidates to their respective input density plots. Agreement with the input depended on the general shape of the density function and the location of the peaks and valleys. Because of its obvious lack of precision, this factor in the selection process was generally weighted less heavily than the other two. Again the cycles in each category have been given a ranking (Table 6) according to this visual test. It must be clarified here that a numerical ranking in this case is of only limited significance. The two previous selection criteria have at least a partial quantative value; the scoring by visual inspection of the density plots, however, is necessarily more subjective. The reader is warned against assuming that the 1-2-3 scoring implies some rigid numerical significance in this third phase of the selection procedure. (For the sake of reference, the power and RPM density functions for the selected cycles as presented in Figures 1-16; the remaining plots are found in Appendix C.)

Table 7 is a summary of the rankings of each candidate cycle based on each of the three criteria as well as a final ranking within each category. Again, the ranking is only a qualitative guage of the cycles' quality since the relative weighting of each criterion is not reflected. The verbal discussion of the cycle selections presented below gives a clearer view of the factors involved in each decision.

Discussion

What follows is a brief rationale for each cycle selection. The chosen cycles, which are listed in Table 1, are denoted by the first three digits of their random number. The summary statistics (Tables 3 and 4), the K-S results (Table 5), and the density functions (Figures 1 - 16 and Appendix C) should be helpful.

LA Gas Non-Freeway: Cycle 203- has the best statistics, of the candidates for this category, but cycle 211- is a close second. The deciding factor was the K-S test on the density function, which showed a better RPM correlation with the input for #203-. The visual check reflected the superior RPM density curve, and #203- was chosen.

Figure 1

L.A. Gas Non-Freeway
203887989

Key: _____ Cycle
----- Input

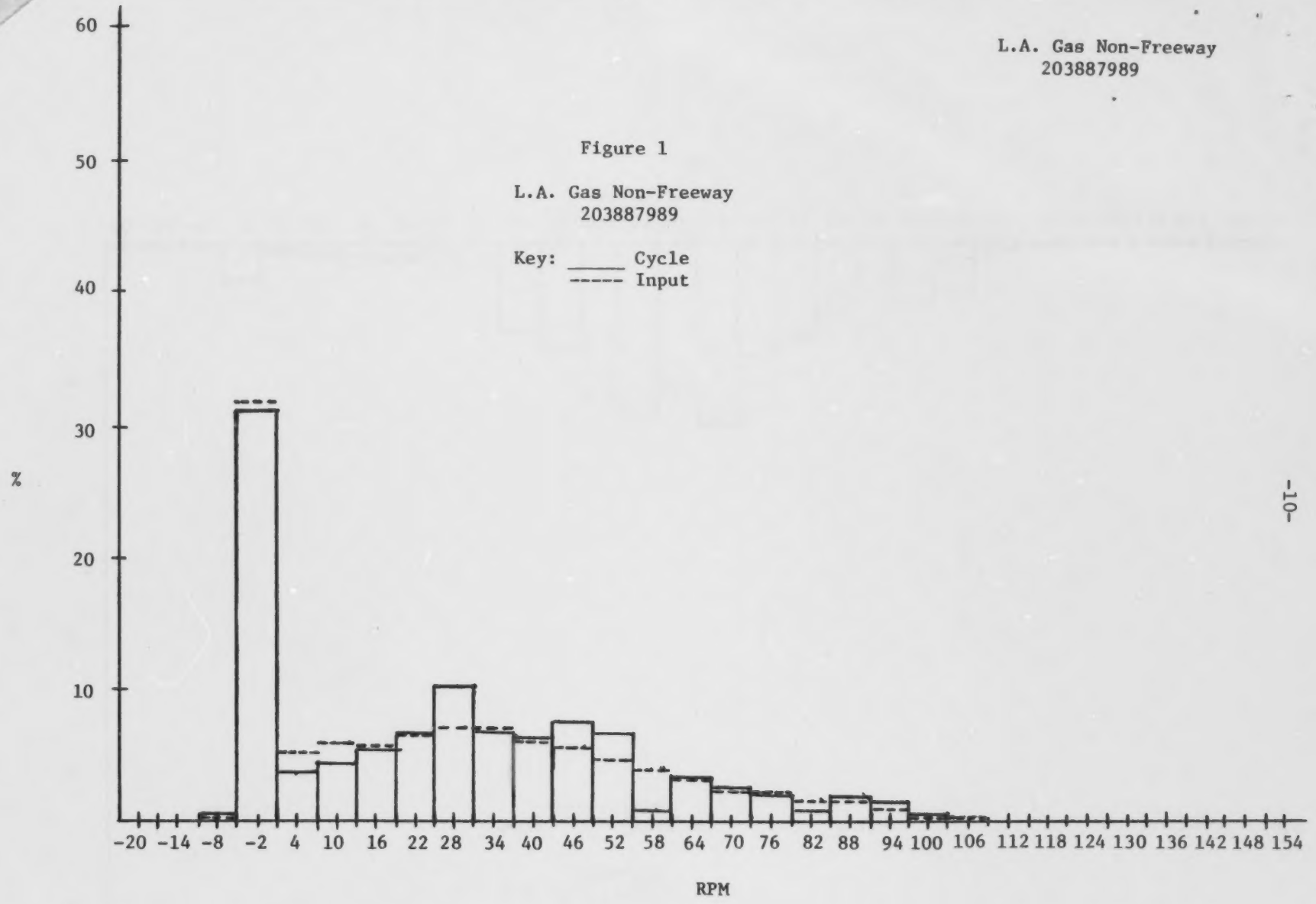


Figure 2

L.A. Gas Freeway
296644805

Key: _____ Cycle
----- Input

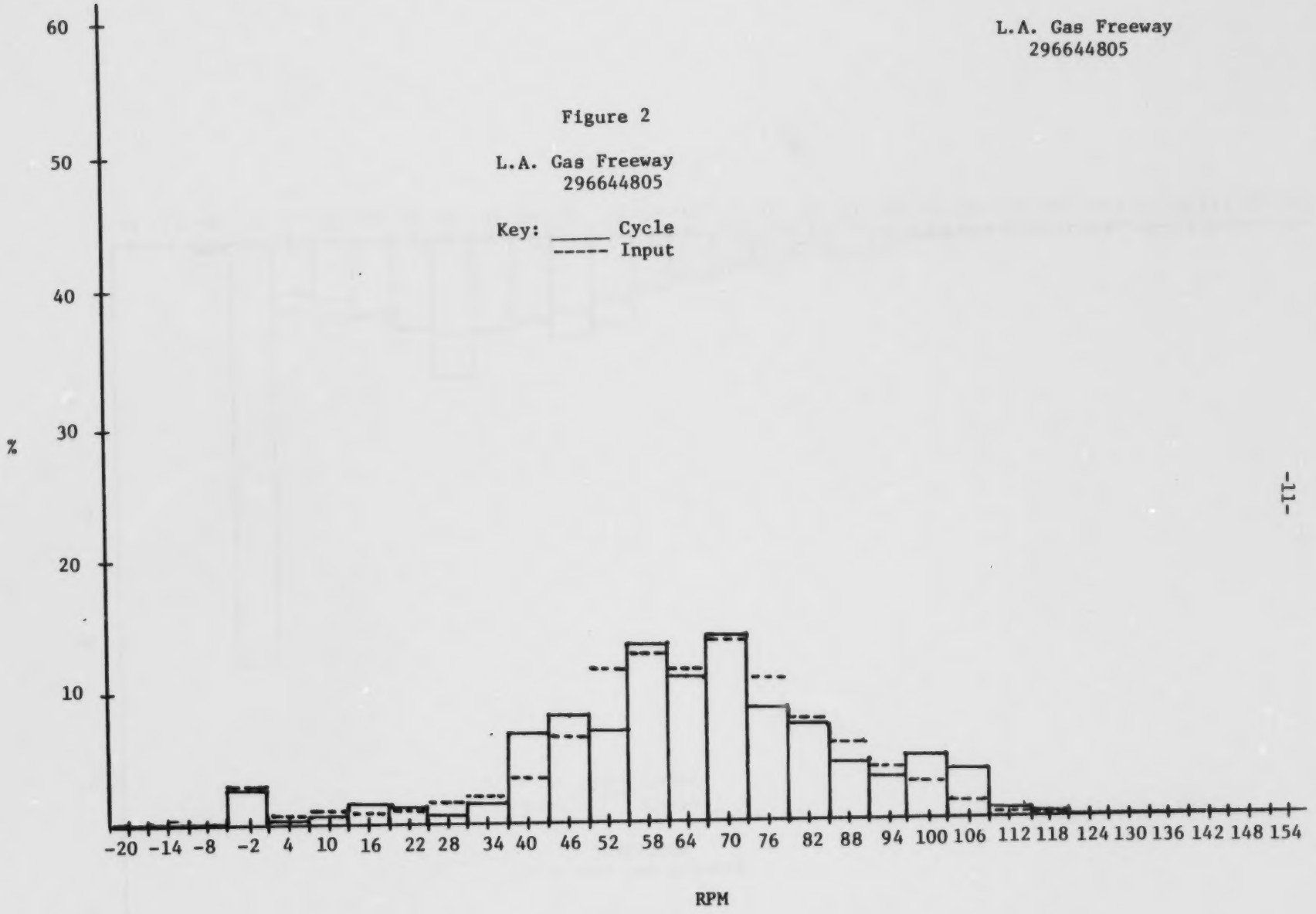


Figure 3

L.A. Diesel Non-Freeway
2110248101

Key: _____ Cycle
----- Input

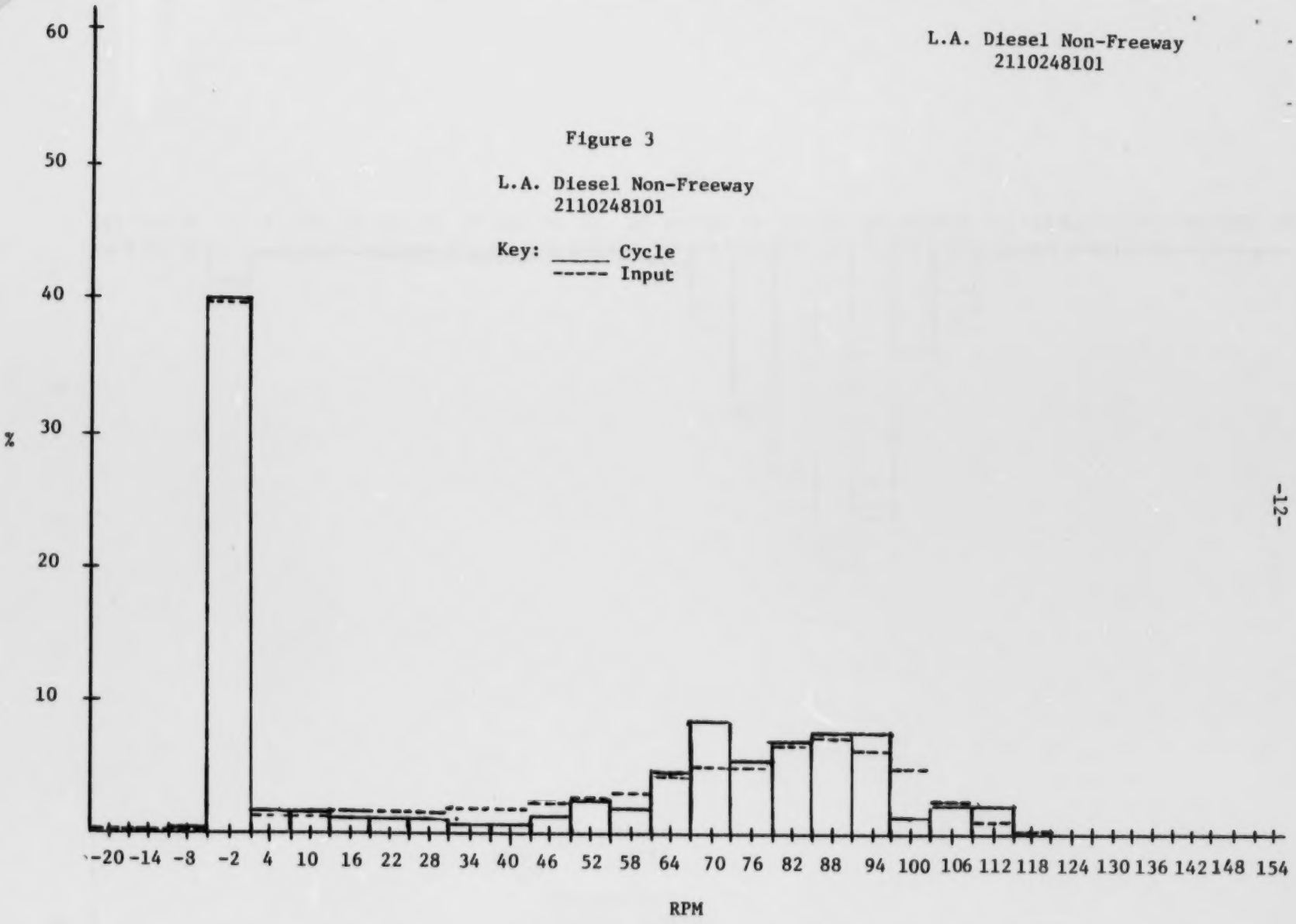


Figure 4

L.A. Diesel Freeway
1599345415

Key: _____ Cycle
----- Input

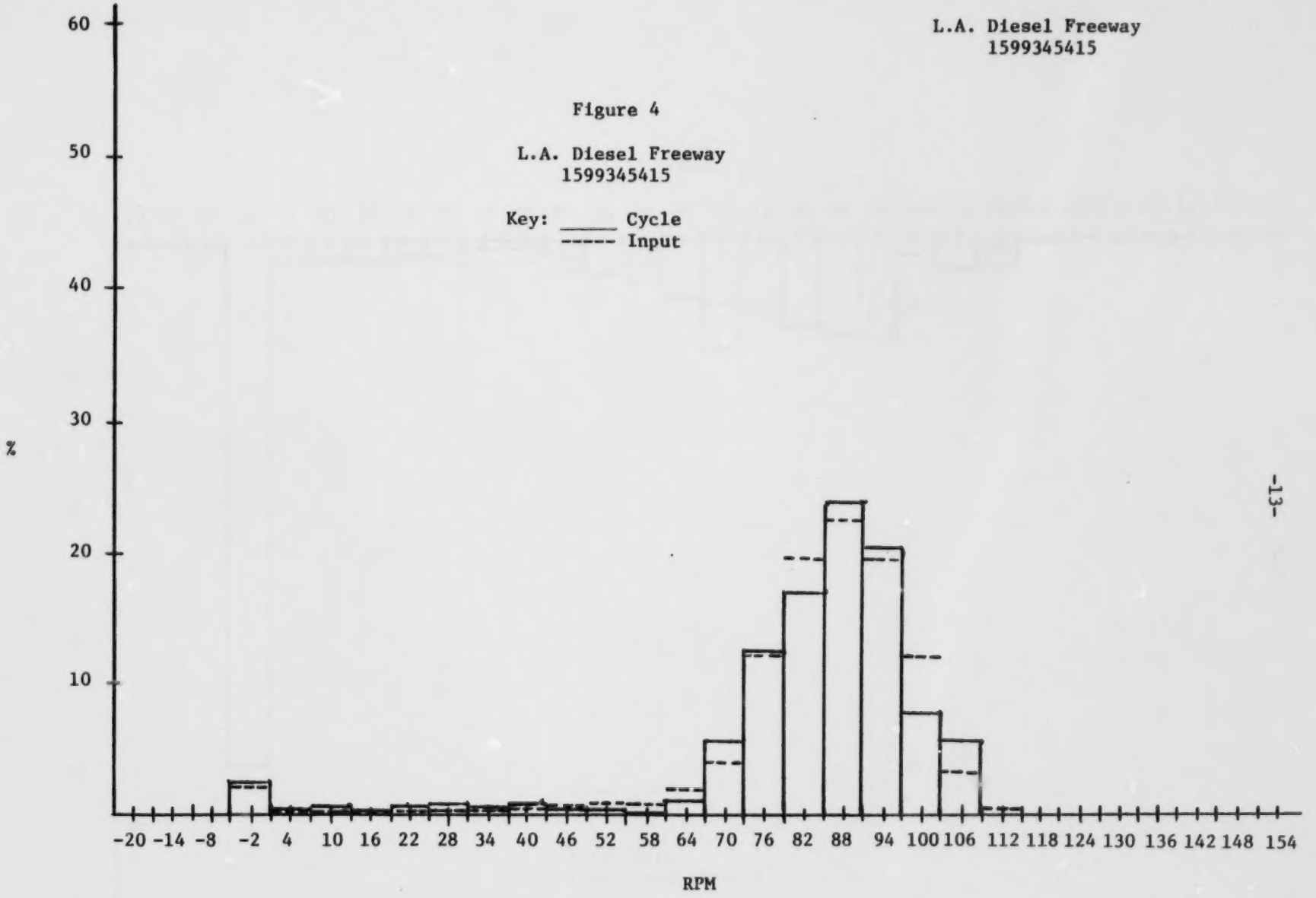


Figure 5

N.Y. Gas Non-Freeway
8410263

Key: _____ Cycle
----- Input

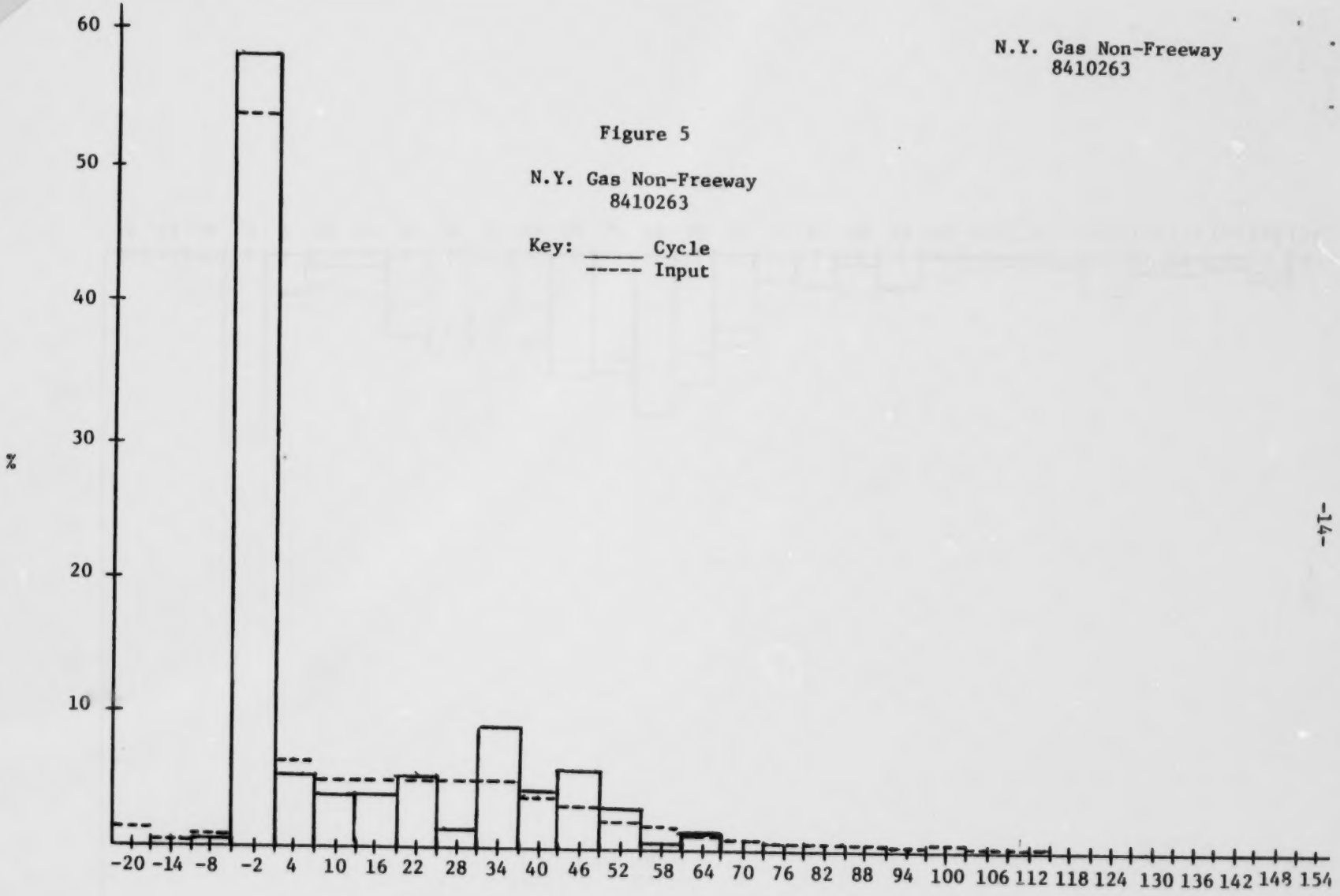


Figure 6

N.Y. Gas Freeway
792043535

Key: _____ Cycle
----- Input

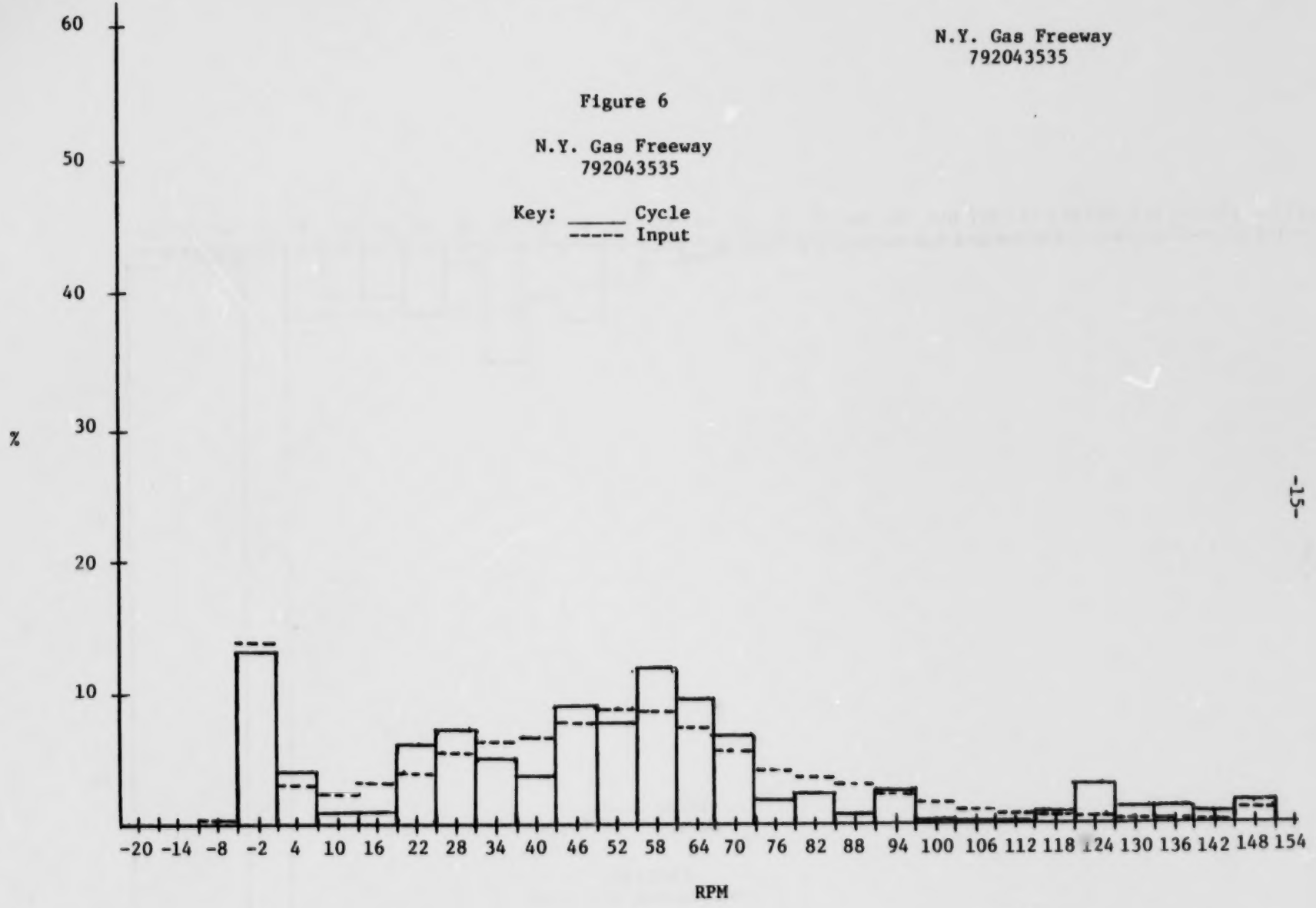


Figure 7

N.Y. Diesel Non-Freeway
2114147447

Key: _____ Cycle
----- Input

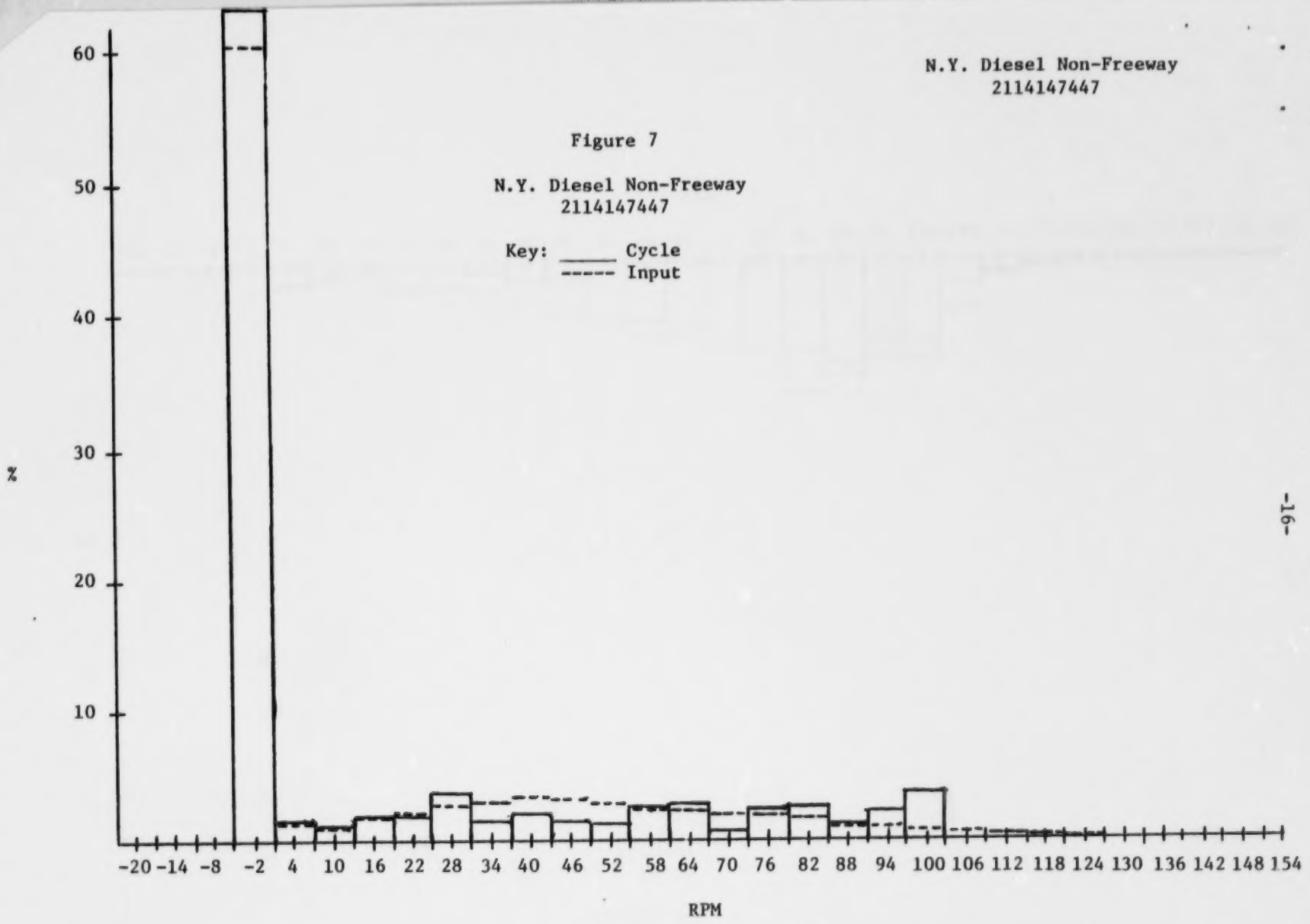


Figure 8

N.Y. Diesel Freeway
104099549

Key: _____ Cycle
----- Input

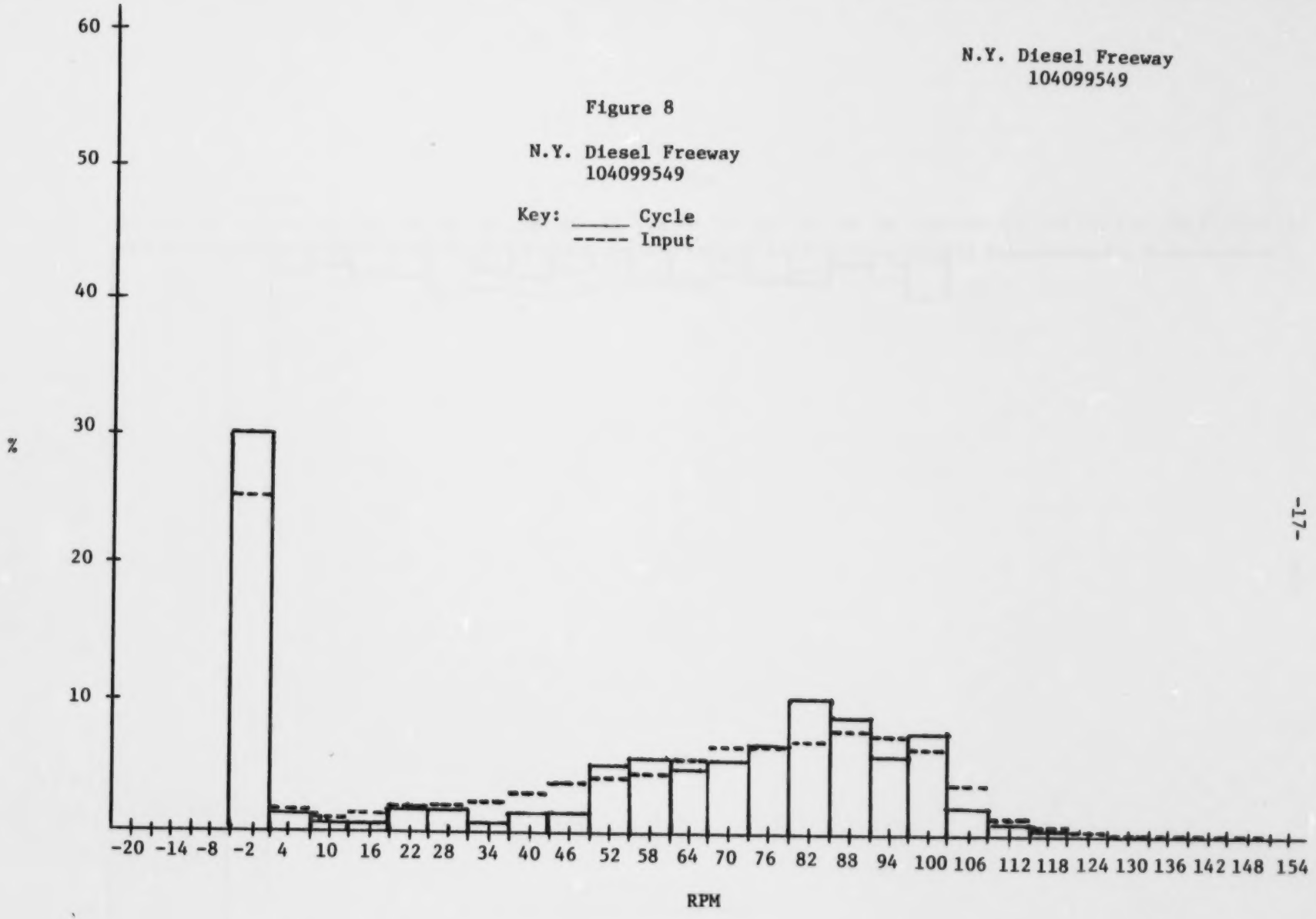
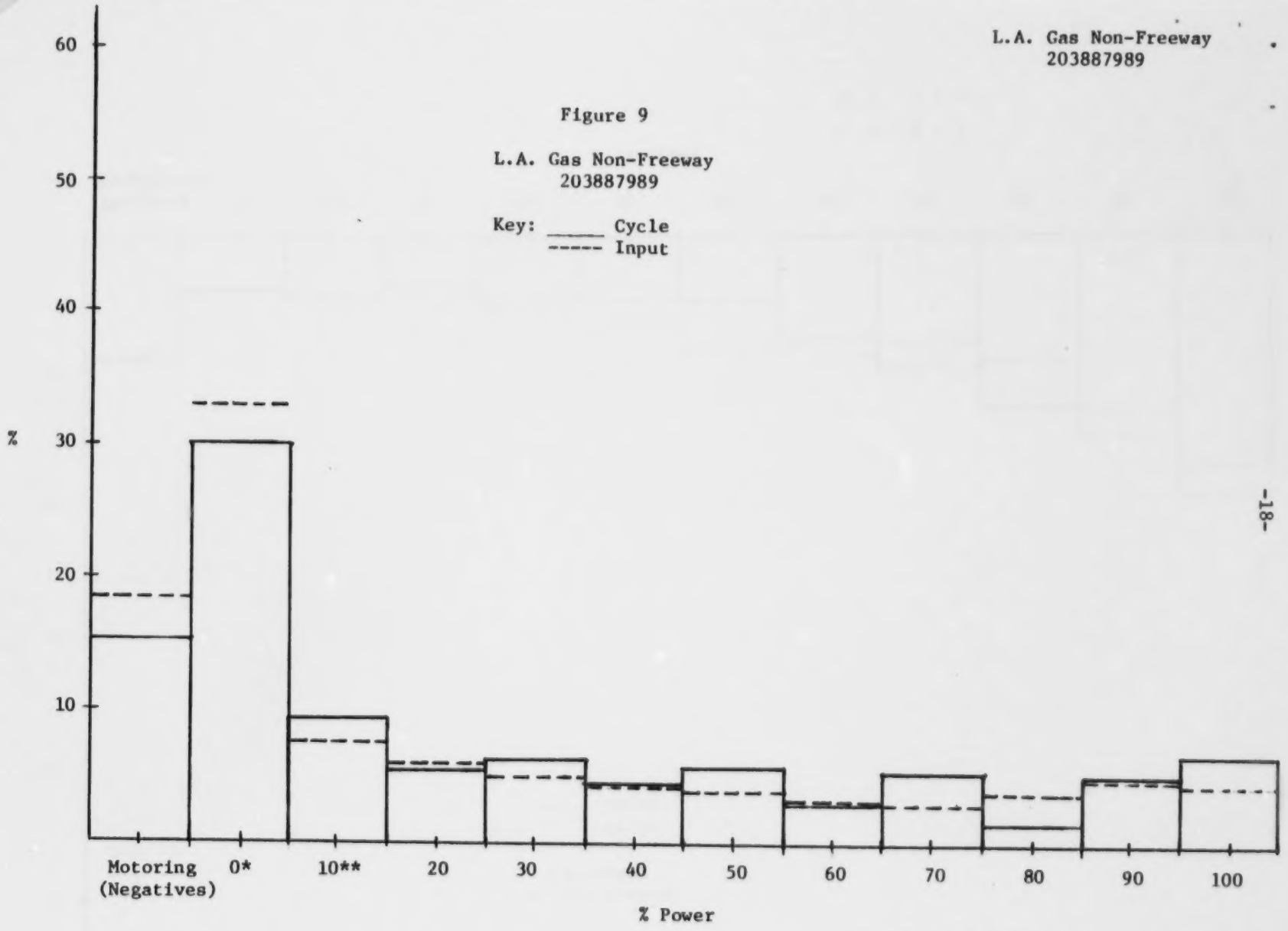


Figure 9

L.A. Gas Non-Freeway
203887989

Key: _____ Cycle
----- Input



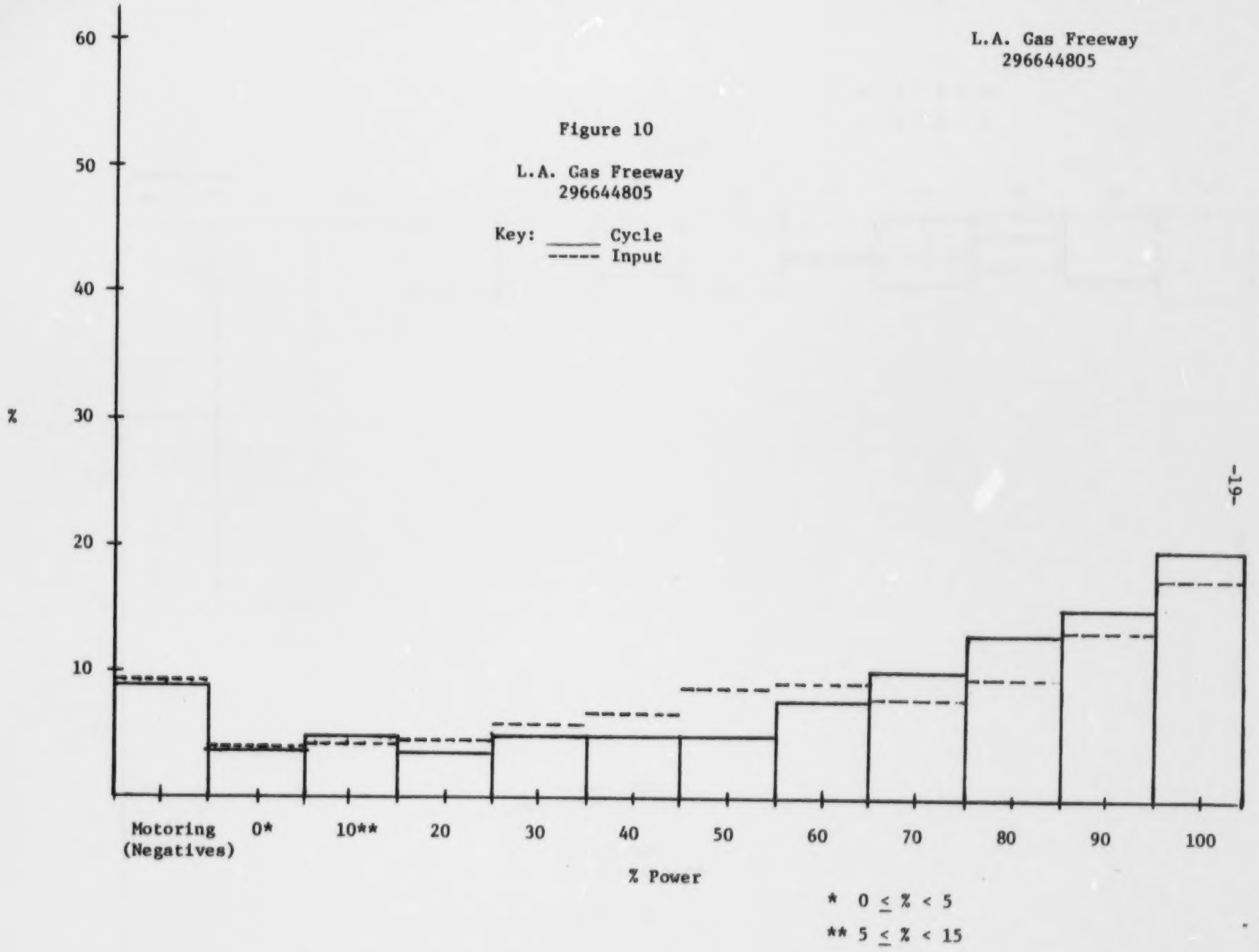
* $0 \leq \% < 5$

** $5 \leq \% < 15$

Figure 10

L.A. Gas Freeway
296644805

Key: _____ Cycle
----- Input



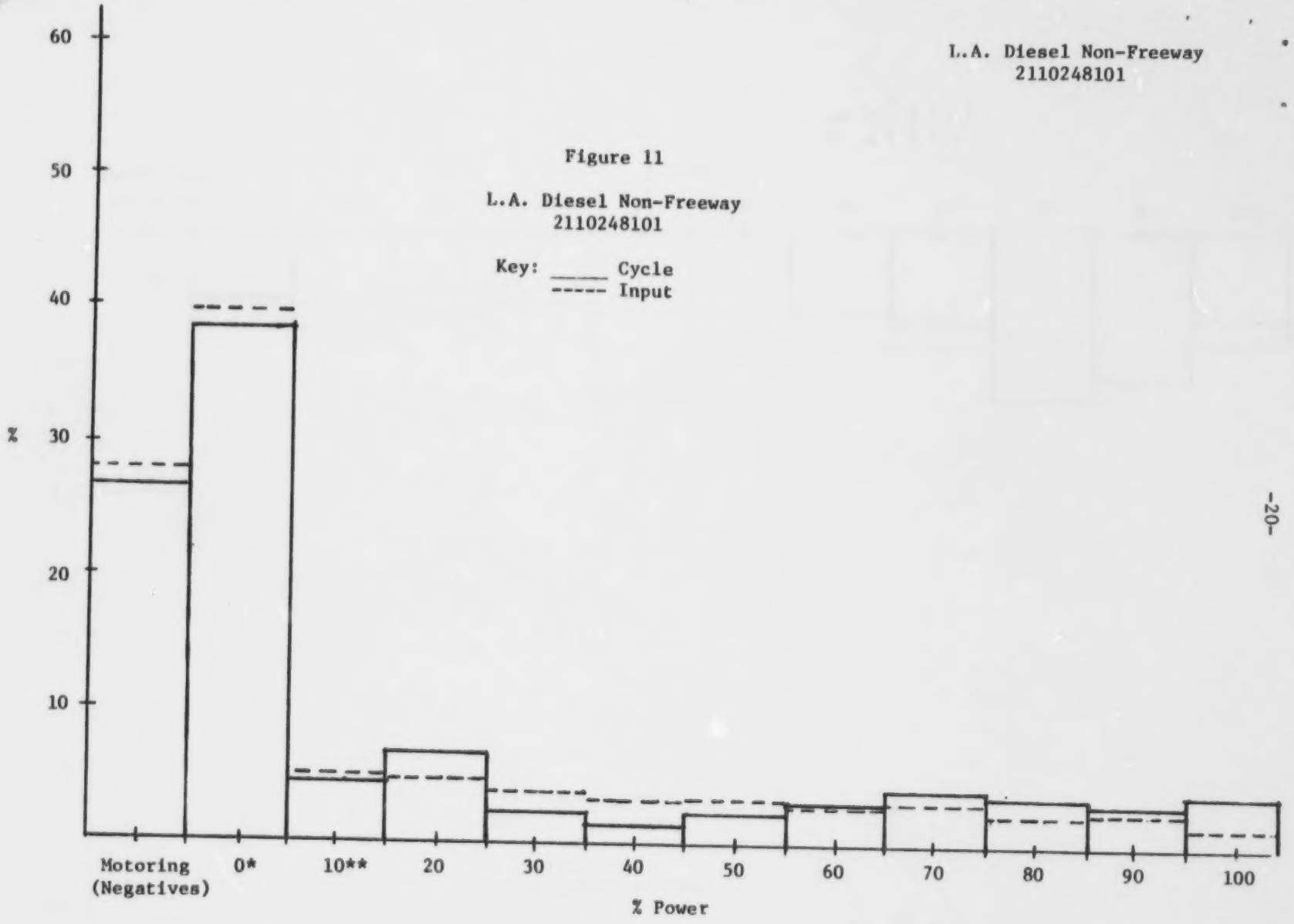
* $0 \leq \% < 5$

** $5 \leq \% < 15$

Figure 11

L.A. Diesel Non-Freeway
2110248101

Key: _____ Cycle
----- Input



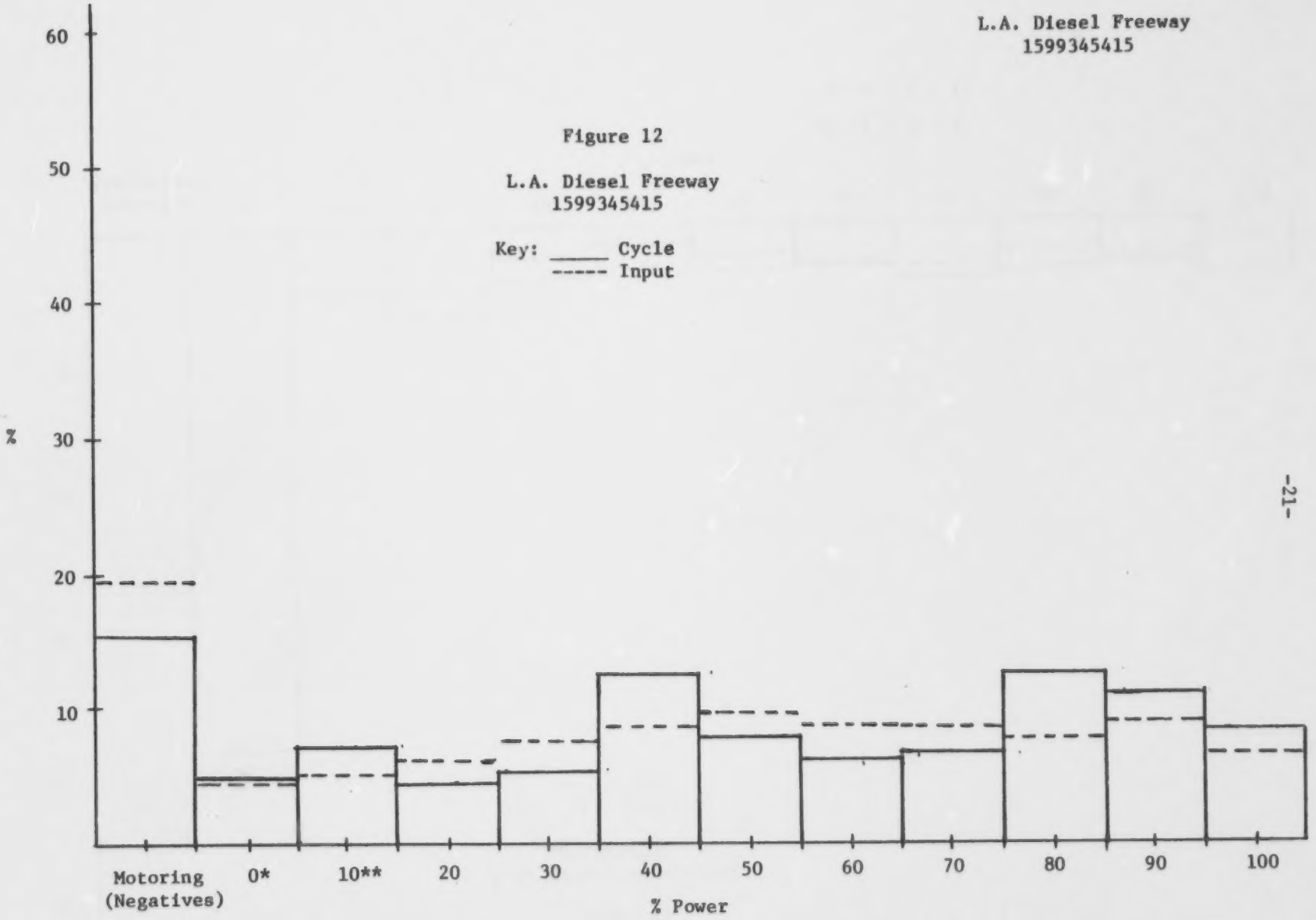
* $0 \leq \% < 5$

** $5 \leq \% < 15$

Figure 12

L.A. Diesel Freeway
1599345415

Key: _____ Cycle
----- Input

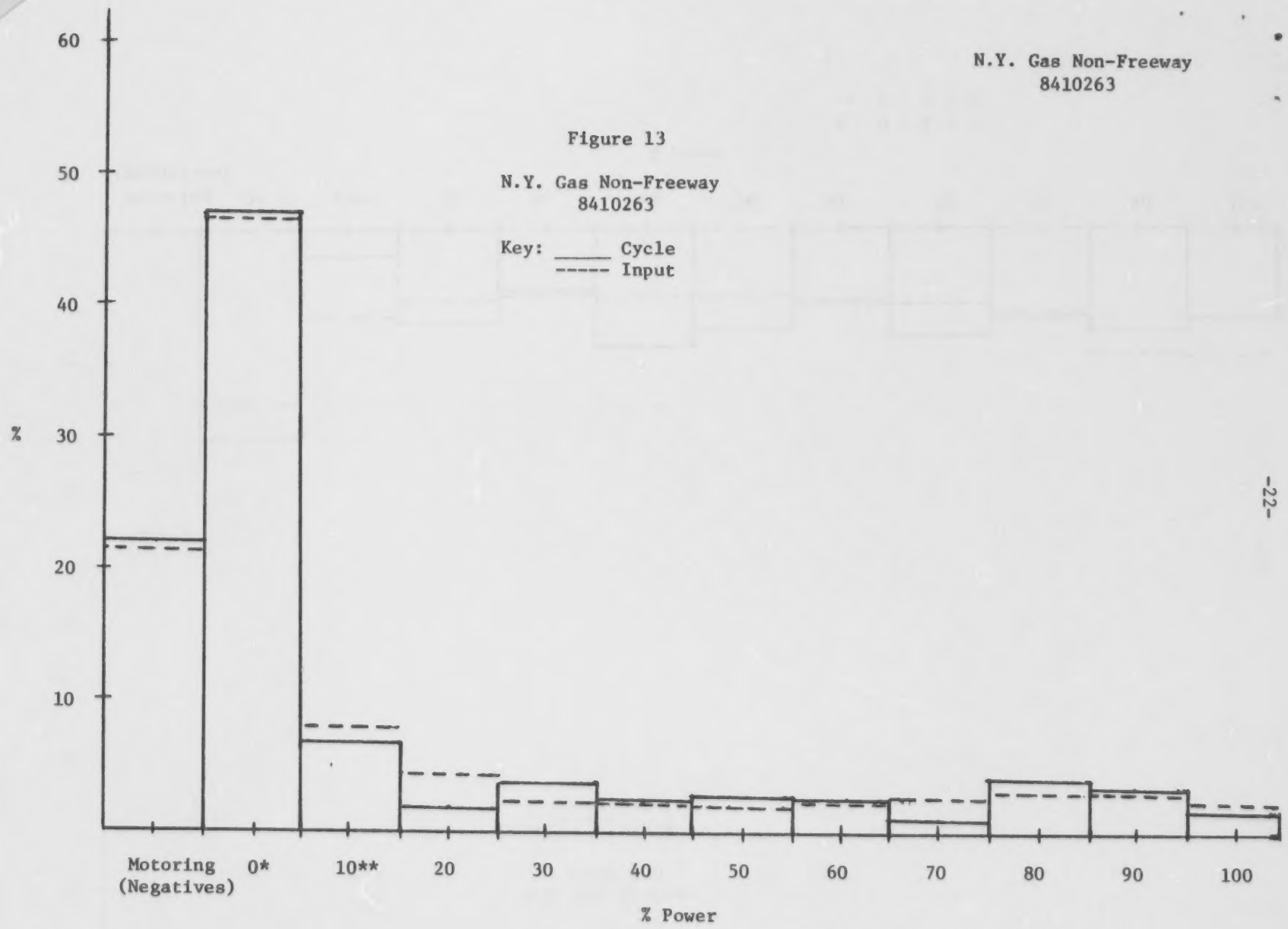


* $0 \leq \% < 5$
** $5 \leq \% < 15$

Figure 13

N.Y. Gas Non-Freeway
8410263

Key: _____ Cycle
----- Input



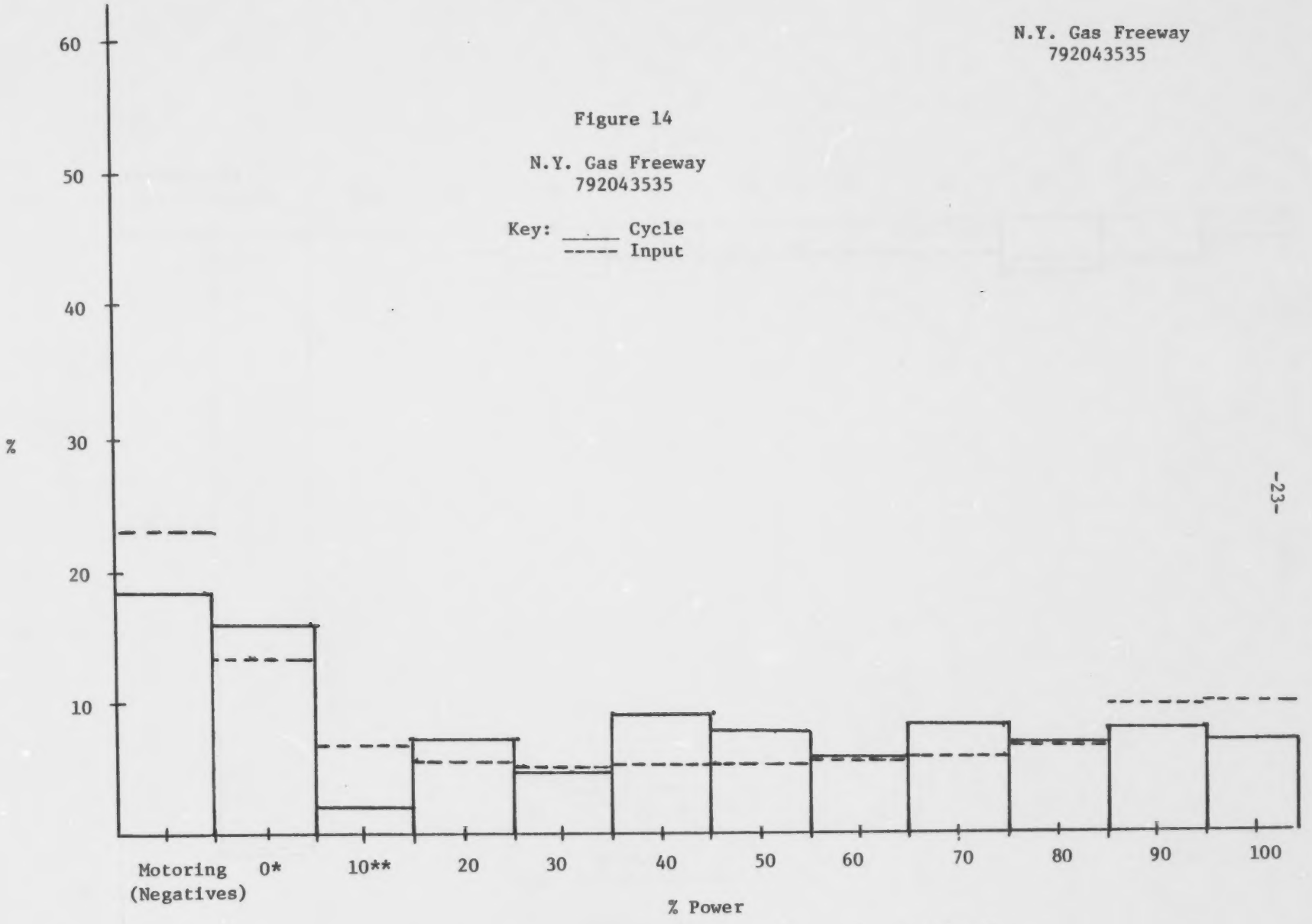
* $0 \leq \% < 5$

** $5 \leq \% < 15$

Figure 14

N.Y. Gas Freeway
792043535

Key: _____ Cycle
----- Input

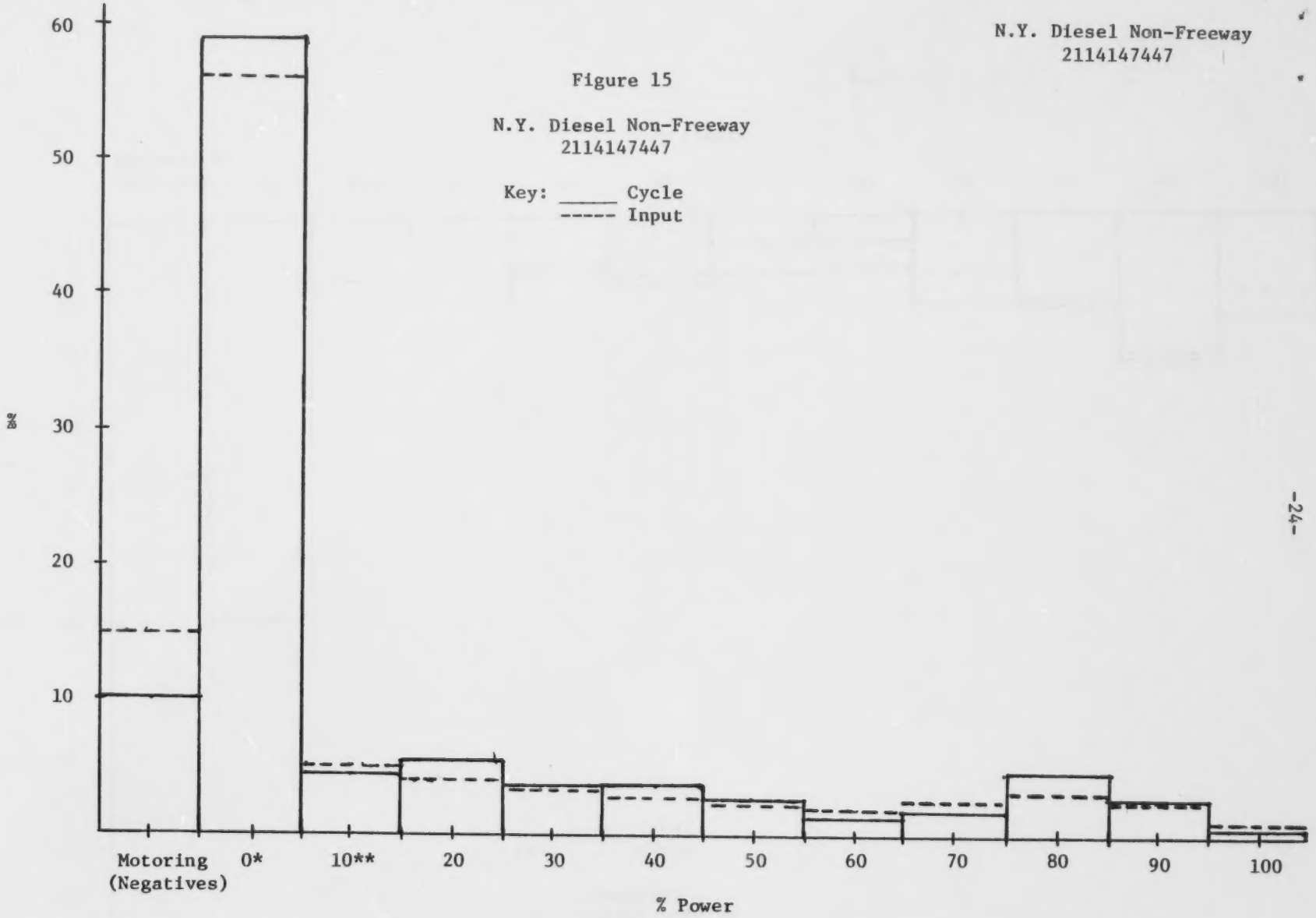


* $0 \leq \% < 5$
** $5 \leq \% < 15$

Figure 15

N.Y. Diesel Non-Freeway
2114147447

Key: _____ Cycle
----- Input

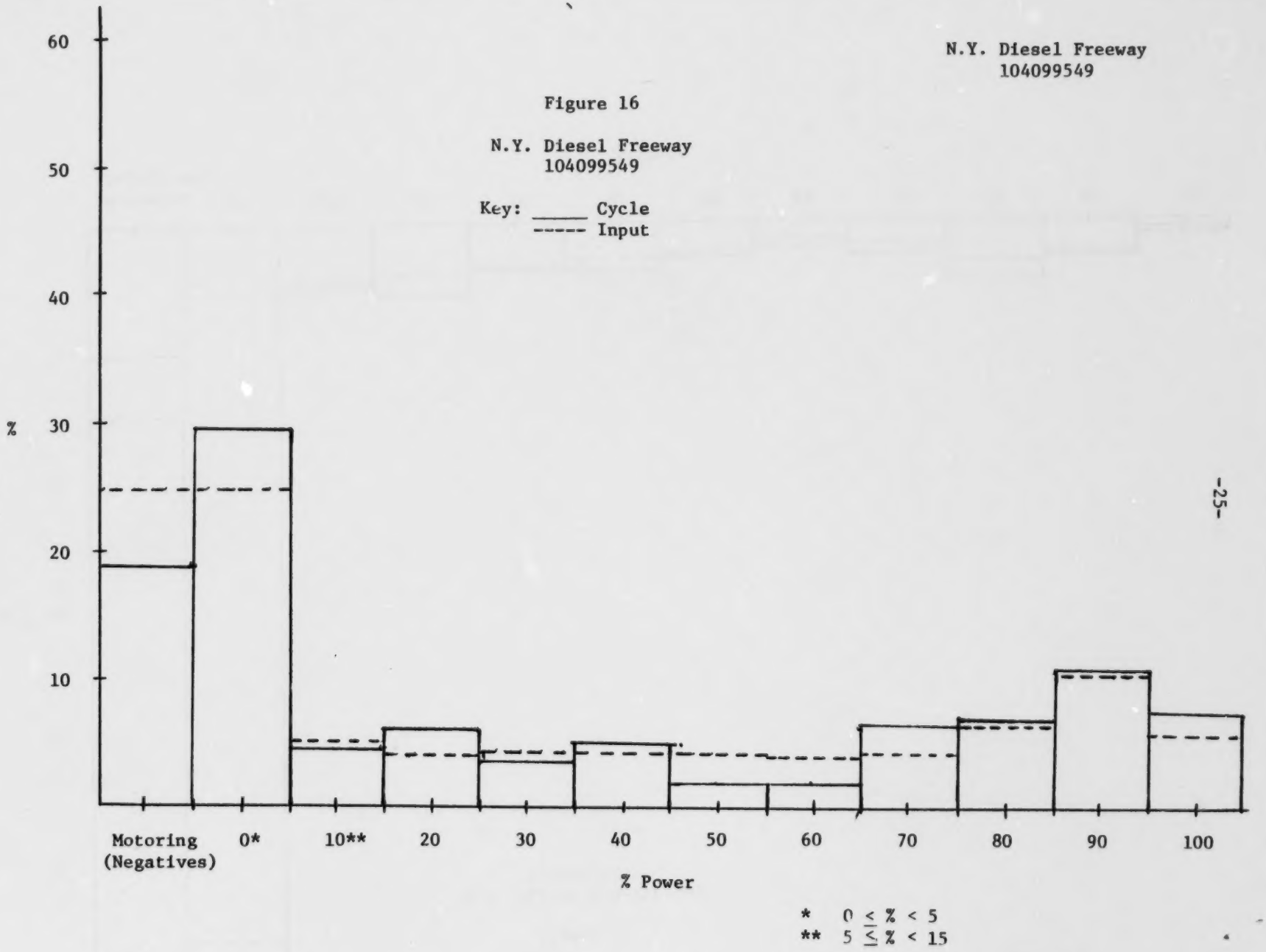


* $0 \leq \% < 5$
$5 \leq \% < 15$

Figure 16

N.Y. Diesel Freeway
104099549

Key: _____ Cycle
----- Input



* 0 ≤ % < 5
** 5 ≤ % < 15

Table 6

Qualitative Ranking Based on Visual Inspection of Plots

	Category		Cycle	Ranking
LA	Gas	Non-Freeway	850-	2
			203-	1
			2113-	2
		Freeway	296-	1
			125-	2
			122-	2
	Diesel	Non-Freeway	2110-	1
			212-	3
			279-	2
		Freeway	159-	1
			109-	1
			110-	1
NY	Gas	Non-Freeway	841-	1
			210-	1
			214-	2
		Freeway	792-	1
			229-	3
			202-	2
	Diesel	Non-Freeway	2114-	1
			2145-	1
			561-	2
		Freeway	812-	2
			769-	3
			104-	1

Table 7

Ranking Summary and Final Rankings

Category			Cycle	Summary Statistics (Table 4)	Distribution K-S Test (Table 5)	Visual Ranking of Plots (Table 6)	Scores	Final Ranking
LA	Gas	Non-Freeway	850-	3	3	2	8	3
			203-	1	1	1	3	1*
			2113-	2	2	2	6	2
		Freeway	296-	1	2	1	4	1*
			125-	3	3	2	8	3
			122-	2	1	2	5	2
	Diesel	Non-Freeway	2110-	1	1	1	3	1*
			212-	3	3	3	9	3
			279-	2	2	2	6	2
		Freeway	159-	1	2	1	4	1*
			109-	2	1	1	4	1
			110-	2	3	1	6	2
NY	Gas	Non-Freeway	841-	1	1	1	3	1*
			210-	3	2	1	6	2
			214-	2	3	2	7	3
		Freeway	792-	1	1	1	3	1*
			229-	3	2	3	8	3
			202-	2	2	2	6	2
	Diesel	Non-Freeway	2114-	2	1	1	4	1*
			2145-	3	1	1	5	2
			561-	1	2	2	5	2
		Freeway	812-	3	2	2	7	3
			769-	1	2	3	6	2
			104-	2	1	1	4	1*

* Indicates the chosen cycle in each category.

LA Gas Freeway: The summary statistics heavily favor cycle 296-, but this cycle fails the density K-S test for power. However, the other candidates also did poorly; and since the K-S difference which failed the power density function is relatively low for #296- * and the RPM test was passed easily, it seemed to be the best choice. Further, comparison of the input and cycle density plots for #296- shows no massive divergence, although there is slightly more operation in the higher power range than might be desirable.

LA Diesel Non-Freeway: Of the three candidates, cycles 211- and 279- are in contention as regards the statistics, with #211- favored on the basis of its high score in the overall matrix K-S significance level (.80). As far as the density K-S correlations are concerned, the chosen cycle 211- is better, as borne out by the density plots themselves (211- shows smoother functions).

LA Diesel Freeway: The statistics clearly favor cycle 159-, especially with the high overall matrix significance level. Cycle 109-, however, scored better on the density K-S test, and visual comparison also showed that both cycles were in contention with respect to density. The final choice of 159- reflects the greater weight given to the summary statistics, although cycle 109- would not have been an unreasonable choice.

NY Gas Non-Freeway: There can be little doubt that cycle 841- is the best choice for this category; both the summary statistics and the density K-S test strongly favor this cycle. The visual check supports the choice as well.

NY Gas Freeway: Again, this choice was not difficult. The best statistics are found for cycle 792-, and it is the only cycle to pass the power density K-S test. The density plots -- especially those depicting RPM-- further bear out this selection.

NY Diesel Non-Freeway: The scoring of the summary statistics showed cycles 211- and 561- to be very close contenders, with #214- a close third. Since all three passed the density K-S test rather nicely, the decision was not clear-cut. Cycle 561- is not as good as the others according to the power K-S test, and #214- is lacking in summary statistics; hence the choice was #211-. The density plots were so similar that the visual test was of little help.

NY Diesel Freeway: In contention here, by the statistics, are cycles 769- and 104-, perhaps with a slight advantage toward the former. However, only #104- passed both the power and RPM K-S tests. Since the density plots for #769 show an excessive amount of operation in the higher power ranges, cycle 104- becomes the reasonable choice.

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* Critical difference was .085 at $\alpha = .01$, maximum difference for cycle was .105.

Conclusions

The table below shows the selected cycle for each category; the cycles are denoted by their random number designations.

	Category		Cycle
LA	Gas	Non-Freeway	203887989
	Gas	Freeway	296644805
	Diesel	Non-Freeway	2110248101
	Diesel	Freeway	1599345415
NY	Gas	Non-Freeway	8410263
	Gas	Freeway	792043535
	Diesel	Non-Freeway	2114147447
	Diesel	Freeway	104099549

Second-by-second listings for these cycles may be found in the Appendix.

These cycles are judged to be the most representative of the CAPE-21 data base. The selections are made based upon statistical considerations only. Further evaluation of the candidate cycles must still be made in terms of the practical aspects of running the cycles on the dynamometer.

APPENDIX A

Sample K-S test on density function

LA Gas Non-Freeway - Cycle 2038877989

RPM

Increment of % RPM	% RPM Cumulative Distr. Function (Input)	% RPM Cumulative Distr. Function (Cycle)	K-S Difference
-20	0	0	0
-14	.001	0	0
- 8	.003	.003	0
- 2	.317	.309	.008
4	.368	.346	.022
10	.424	.388	.036
16	.478	.439	.039*
22	.540	.504	.036
28	.606	.605	.001
34	.672	.667	.005
40	.733	.729	.004
46	.788	.802	-.014
52	.834	.867	-.033
58	.872	.875	-.003
64	.903	.906	-.003
70	.930	.931	-.001
76	.951	.948	-.003
82	.968	.954	.014
88	.982	.971	.011
94	.990	.985	.005
100	.944	.988	.006
106	.995	.988	.007
112	.996	.988	.008
118	.996	.988	.008
124	.996	.988	.008

The * indicates the maximum difference incurred in the test -- .039. The sample size (number of records) for this cycle is 356; so, by Table 2, the critical difference for a significance level of .20 is .057. Thus the cycle passes this RPM test at the high .20 level.

APPENDIX B

Second-by-Second Listings of Selected Cycles

CYCLE #203 887 7489

LOS ANGELES · All Gasoline

NON-FREEWAY

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SECOND	% RPM	% POWER
0.	0.0	0.0
1.	0.0	0.0
2.	0.0	0.0
3.	0.0	0.0
4.	0.0	0.0
5.	0.0	0.0
6.	0.0	0.0
7.	0.0	0.0
8.	0.0	0.0
9.	0.0	4.17
10.	1.15	10.00
11.	2.00	10.00
12.	0.22	10.00
13.	0.0	0.0
14.	0.0	0.0
15.	0.0	0.0
16.	0.0	0.0
17.	0.0	0.0
18.	0.0	0.0
19.	0.0	0.0
20.	0.0	0.0
21.	0.0	0.0
22.	0.0	0.0
23.	0.0	0.0
24.	0.0	0.0
25.	0.0	0.0
26.	0.0	0.0
27.	0.0	0.0
28.	0.0	4.07
29.	0.0	10.00
30.	0.0	17.22
31.	0.0	20.00
32.	0.0	20.37
33.	2.33	31.94
34.	16.22	36.48
35.	24.00	24.91
36.	24.00	13.34
37.	19.06	10.00
38.	19.00	MOTORING
39.	17.17	MOTORING
40.	9.08	MOTORING
41.	1.09	MOTORING
42.	0.0	0.0
43.	0.0	0.0
44.	0.0	0.0
45.	0.0	0.0
46.	0.0	0.0
47.	0.0	0.0
48.	0.0	0.0
49.	0.0	0.0

SECOND	% RPM	% POWER
50.	0.0	0.0
51.	0.0	0.82
52.	0.37	41.08
53.	2.68	90.00
54.	6.00	94.99
55.	11.94	100.00
56.	15.63	100.00
57.	41.26	90.28
58.	46.26	70.00
59.	48.56	67.08
60.	36.00	1.12
61.	27.58	50.12
62.	23.52	90.00
63.	24.00	90.00
64.	26.29	70.00
65.	30.00	65.38
66.	30.00	34.47
67.	30.00	10.00
68.	30.00	10.00
69.	30.00	10.00
70.	30.18	60.00
71.	40.00	58.25
72.	40.67	50.00
73.	41.02	50.00
74.	40.00	50.00
75.	41.61	50.00
76.	42.00	50.00
77.	46.00	50.00
78.	49.22	50.00
79.	59.21	58.69
80.	67.18	70.00
81.	71.00	70.00
82.	72.00	70.00
83.	72.13	69.08
84.	74.89	28.94
85.	68.91	MOTORING
86.	49.71	MOTORING
87.	41.84	MOTORING
88.	38.30	MOTORING
89.	35.93	MOTORING
90.	28.00	MOTORING
91.	23.48	MOTORING
92.	10.16	MOTORING
93.	4.72	MOTORING
94.	0.82	5.90
95.	-9.53	19.53
96.	2.20	45.60
97.	20.53	7.33
98.	21.15	0.0
99.	17.67	MOTORING

SECOND	% RPM	% POWER
100.	13.04	MOTORING
101.	8.41	79.70
102.	10.33	100.00
103.	17.27	100.00
104.	22.00	100.00
105.	25.16	100.00
106.	29.37	100.00
107.	36.73	66.35
108.	40.00	MOTORING
109.	23.50	MOTORING
110.	9.37	MOTORING
111.	8.00	MOTORING
112.	6.74	MOTORING
113.	2.86	MOTORING
114.	0.11	MOTORING
115.	0.0	MOTORING
116.	0.0	0.0
117.	0.0	0.0
118.	0.0	0.0
119.	0.0	0.0
120.	0.0	0.0
121.	0.0	0.0
122.	0.0	0.0
123.	0.0	0.0
124.	0.0	0.0
125.	0.0	0.0
126.	0.0	0.0
127.	0.0	0.0
128.	0.0	0.0
129.	0.0	0.0
130.	0.0	0.0
131.	0.0	0.0
132.	0.0	0.0
133.	0.0	0.0
134.	0.0	0.0
135.	0.0	0.0
136.	0.0	0.0
137.	0.0	0.0
138.	0.0	0.0
139.	0.0	0.0
140.	0.0	0.0
141.	0.0	0.0
142.	0.0	0.0
143.	0.0	0.0
144.	0.0	0.0
145.	0.0	0.0
146.	0.0	0.0
147.	2.27	20.00
148.	2.82	14.11
149.	0.0	0.0

SECOND	% RPM	% POWER
150.	0.0	0.0
151.	0.0	0.0
152.	0.0	0.0
153.	0.0	0.0
154.	0.0	0.0
155.	0.0	0.0
156.	0.0	0.0
157.	0.0	0.0
158.	0.0	0.0
159.	0.26	0.78
160.	16.60	31.83
161.	45.32	29.78
162.	43.00	10.00
163.	40.69	10.00
164.	35.12	10.00
165.	28.18	19.70
166.	28.26	47.65
167.	30.00	30.00
168.	30.00	30.00
169.	30.00	30.00
170.	34.54	30.00
171.	36.00	30.00
172.	36.43	30.00
173.	43.84	30.00
174.	50.00	30.00
175.	50.00	24.56
176.	50.00	20.00
177.	50.00	-999.99
178.	37.97	-999.99
179.	35.30	-999.99
180.	30.68	-999.99
181.	27.02	-999.99
182.	26.00	-999.99
183.	26.00	-999.99
184.	20.24	-999.99
185.	14.00	-999.99
186.	13.45	18.27
187.	9.40	52.99
188.	10.72	81.81
189.	15.50	97.48
190.	19.62	100.00
191.	20.25	100.00
192.	25.76	100.00
193.	35.02	100.00
194.	42.14	94.65
195.	44.00	90.00
196.	45.70	90.00
197.	51.99	60.00
198.	50.00	60.00
199.	51.29	63.22

CYCLE #203887989

(Page 2)

SECONDS	% RPM	% POWER	SECONDS	% RPM	% POWER	SECONDS	% RPM	% POWER			
200.	54.96	70.00	250.	67.38	56.88	300.	17.59	MOTORING	-0.	-0.00	-0.00
201.	56.00	70.00	251.	80.02	54.96	301.	11.65	MOTORING	-0.	-0.00	-0.00
202.	62.15	38.25	252.	93.95	66.34	302.	1.92	MOTORING	-0.	-0.00	-0.00
203.	71.61	30.00	253.	97.63	63.69	303.	0.0	0.0	-0.	-0.00	-0.00
204.	76.22	50.00	254.	94.11	60.00	304.	0.0	0.0	-0.	-0.00	-0.00
205.	78.00	50.00	255.	85.66	MOTORING	305.	0.0	0.0	-0.	-0.00	-0.00
206.	78.00	41.53	256.	70.00	MOTORING	306.	0.0	0.0	-0.	-0.00	-0.00
207.	55.93	12.58	257.	69.11	MOTORING	307.	0.0	0.0	-0.	-0.00	-0.00
208.	39.52	0.0	258.	66.80	MOTORING	-0.	-0.00	-0.00	-0.	-0.00	-0.00
209.	38.42	71.65	259.	64.48	MOTORING	-0.	-0.00	-0.00	-0.	-0.00	-0.00
210.	36.11	79.47	260.	53.00	44.98	-0.	-0.00	-0.00	-0.	-0.00	-0.00
211.	38.84	67.90	261.	52.73	49.27	-0.	-0.00	-0.00	-0.	-0.00	-0.00
212.	42.79	60.00	262.	62.00	40.00	-0.	-0.00	-0.00	-0.	-0.00	-0.00
213.	44.00	58.75	263.	62.00	43.88	-0.	-0.00	-0.00	-0.	-0.00	-0.00
214.	49.46	36.35	264.	64.18	44.55	-0.	-0.00	-0.00	-0.	-0.00	-0.00
215.	52.00	30.00	265.	53.36	4.88	-0.	-0.00	-0.00	-0.	-0.00	-0.00
216.	12.05	MOTORING	266.	46.28	15.79	-0.	-0.00	-0.00	-0.	-0.00	-0.00
217.	25.69	0.0	267.	46.00	19.83	-0.	-0.00	-0.00	-0.	-0.00	-0.00
218.	24.00	0.0	268.	45.65	10.00	-0.	-0.00	-0.00	-0.	-0.00	-0.00
219.	24.00	MOTORING	269.	45.99	10.00	-0.	-0.00	-0.00	-0.	-0.00	-0.00
220.	20.24	MOTORING	270.	48.05	10.00	-0.	-0.00	-0.00	-0.	-0.00	-0.00
221.	10.16	68.43	271.	44.71	1.58	-0.	-0.00	-0.00	-0.	-0.00	-0.00
222.	9.00	80.58	272.	48.82	MOTORING	-0.	-0.00	-0.00	-0.	-0.00	-0.00
223.	10.20	80.99	273.	51.92	66.82	-0.	-0.00	-0.00	-0.	-0.00	-0.00
224.	13.58	90.00	274.	47.53	MOTORING	-0.	-0.00	-0.00	-0.	-0.00	-0.00
225.	18.00	94.13	275.	36.31	9.23	-0.	-0.00	-0.00	-0.	-0.00	-0.00
226.	20.28	100.00	276.	17.73	55.68	-0.	-0.00	-0.00	-0.	-0.00	-0.00
227.	22.09	100.00	277.	29.43	38.22	-0.	-0.00	-0.00	-0.	-0.00	-0.00
228.	23.77	91.15	278.	36.00	37.46	-0.	-0.00	-0.00	-0.	-0.00	-0.00
229.	28.08	90.00	279.	36.00	40.00	-0.	-0.00	-0.00	-0.	-0.00	-0.00
230.	30.00	86.01	280.	34.00	40.00	-0.	-0.00	-0.00	-0.	-0.00	-0.00
231.	32.85	80.70	281.	34.00	40.00	-0.	-0.00	-0.00	-0.	-0.00	-0.00
232.	32.86	100.00	282.	34.00	36.25	-0.	-0.00	-0.00	-0.	-0.00	-0.00
233.	31.37	100.00	283.	38.26	24.68	-0.	-0.00	-0.00	-0.	-0.00	-0.00
234.	16.00	100.00	284.	43.38	61.38	-0.	-0.00	-0.00	-0.	-0.00	-0.00
235.	51.77	100.00	285.	50.78	46.12	-0.	-0.00	-0.00	-0.	-0.00	-0.00
236.	60.57	95.72	286.	52.00	19.92	-0.	-0.00	-0.00	-0.	-0.00	-0.00
237.	64.00	70.00	287.	52.32	0.0	-0.	-0.00	-0.00	-0.	-0.00	-0.00
238.	64.91	70.00	288.	52.09	3.19	-0.	-0.00	-0.00	-0.	-0.00	-0.00
239.	75.83	70.00	289.	48.00	10.00	-0.	-0.00	-0.00	-0.	-0.00	-0.00
240.	82.00	70.00	290.	48.00	10.00	-0.	-0.00	-0.00	-0.	-0.00	-0.00
241.	85.72	51.42	291.	48.00	10.00	-0.	-0.00	-0.00	-0.	-0.00	-0.00
242.	86.17	49.14	292.	30.94	19.48	-0.	-0.00	-0.00	-0.	-0.00	-0.00
243.	88.49	35.13	293.	28.00	20.00	-0.	-0.00	-0.00	-0.	-0.00	-0.00
244.	90.00	15.99	294.	28.00	20.00	-0.	-0.00	-0.00	-0.	-0.00	-0.00
245.	91.12	26.74	295.	28.00	15.81	-0.	-0.00	-0.00	-0.	-0.00	-0.00
246.	92.00	32.85	296.	28.00	10.00	-0.	-0.00	-0.00	-0.	-0.00	-0.00
247.	93.74	30.00	297.	26.53	10.00	-0.	-0.00	-0.00	-0.	-0.00	-0.00
248.	89.29	MOTORING	298.	26.00	10.00	-0.	-0.00	-0.00	-0.	-0.00	-0.00
249.	66.00	41.87	299.	23.71	MOTORING	-0.	-0.00	-0.00	-0.	-0.00	-0.00

CYCLE # 296 644 805
LOS ANGELES - All Gasoline
FREEWAY

SECONDS	% RPM	% POWER	SEC	% RPM	% POWER	SEC	% RPM	% POWER	SEC	% RPM	% POWER
0.	0.0	0.0	50.	48.26	90.00	100.	60.00	92.60	150.	80.00	-999.99
1.	0.0	0.0	51.	48.00	89.73	101.	60.00	90.00	151.	80.00	-999.99
2.	0.0	0.0	52.	48.37	80.00	102.	60.00	90.00	152.	80.00	63.93
3.	0.0	0.0	53.	49.32	80.00	103.	60.42	90.00	153.	84.00	80.00
4.	1.26	25.19	54.	48.00	80.00	104.	62.74	90.00	154.	85.43	82.39
5.	6.72	47.87	55.	48.00	80.00	105.	65.05	90.00	155.	87.62	93.96
6.	13.67	40.56	56.	48.00	80.00	106.	66.00	83.16	156.	84.00	100.00
7.	16.20	80.00	57.	48.00	70.29	107.	66.00	71.59	157.	84.00	100.00
8.	19.52	80.00	58.	48.00	70.00	108.	66.00	70.00	158.	84.00	91.32
9.	25.83	75.83	59.	48.00	70.00	109.	66.00	70.00	159.	86.00	100.00
10.	35.15	70.00	60.	48.00	74.44	110.	66.00	73.14	160.	86.73	100.00
11.	39.93	77.31	61.	48.00	61.96	111.	66.00	80.00	161.	90.00	96.59
12.	41.78	80.00	62.	49.52	50.00	112.	66.00	86.28	162.	91.99	90.00
13.	40.00	10.00	63.	50.00	50.00	113.	66.00	90.00	163.	94.00	90.00
14.	40.00	20.18	64.	50.00	40.00	114.	66.00	90.00	164.	95.63	81.87
15.	40.00	52.78	65.	50.00	44.62	115.	68.20	100.00	165.	96.00	89.70
16.	40.00	34.82	66.	50.78	60.00	116.	70.00	100.00	166.	100.00	98.72
17.	40.00	30.00	67.	52.00	49.09	117.	70.00	100.00	167.	100.57	78.60
18.	40.00	39.33	68.	52.00	40.00	118.	70.00	100.00	168.	102.88	50.00
19.	40.00	30.09	69.	52.00	40.00	119.	74.38	100.00	169.	104.00	73.99
20.	38.30	100.00	70.	52.04	40.89	120.	76.00	100.00	170.	104.00	90.00
21.	40.61	100.00	71.	54.00	90.00	121.	72.09	100.00	171.	104.00	25.98
22.	42.00	100.00	72.	54.00	90.00	122.	73.60	100.00	172.	103.71	20.00
23.	42.00	100.00	73.	54.00	85.10	123.	72.00	100.00	173.	99.54	20.00
24.	42.00	100.00	74.	55.29	73.51	124.	72.00	100.00	174.	98.00	20.00
25.	42.00	100.00	75.	56.00	70.00	125.	72.00	100.00	175.	99.09	25.44
26.	42.00	100.00	76.	56.00	70.00	126.	72.00	100.00	176.	98.60	65.09
27.	42.50	97.50	77.	56.00	60.00	127.	72.00	100.00	177.	103.15	80.00
28.	43.19	85.93	78.	56.00	57.23	128.	72.29	100.00	178.	100.03	80.00
29.	43.13	85.65	79.	56.00	50.00	129.	73.39	100.00	179.	102.35	80.00
30.	44.00	90.00	80.	56.00	38.17	130.	72.92	100.00	180.	104.00	73.38
31.	43.00	90.00	81.	56.00	30.00	131.	74.00	100.00	181.	104.00	55.11
32.	44.00	80.00	82.	56.00	30.00	132.	74.00	100.00	182.	101.42	30.62
33.	44.00	80.00	83.	54.00	39.36	133.	77.73	100.00	183.	98.39	11.97
34.	44.70	80.00	84.	54.00	27.79	134.	78.00	100.00	184.	57.65	-999.99
35.	46.00	74.91	85.	54.00	20.00	135.	77.50	100.00	185.	58.00	-999.99
36.	46.00	63.38	86.	54.00	20.00	136.	76.00	100.00	186.	57.45	-999.99
37.	46.00	60.00	87.	54.00	20.00	137.	76.00	100.00	187.	56.00	-999.99
38.	46.00	60.00	88.	54.00	11.42	138.	76.00	100.00	188.	56.00	-999.99
39.	44.00	10.00	89.	54.00	0.00	139.	72.49	100.00	189.	56.00	27.39
40.	44.00	10.00	90.	54.00	13.31	140.	71.79	100.00	190.	56.00	40.00
41.	43.09	10.00	91.	54.00	30.00	141.	67.16	100.00	191.	56.00	50.00
42.	42.00	10.00	92.	54.96	30.00	142.	72.70	100.00	192.	56.00	45.60
43.	42.09	10.00	93.	57.28	30.00	143.	75.02	100.00	193.	56.00	33.77
44.	43.45	19.26	94.	56.41	30.00	144.	73.34	100.00	194.	56.00	40.00
45.	50.00	90.00	95.	57.91	30.00	145.	73.64	91.78	195.	60.15	5.40
46.	50.00	90.00	96.	58.22	36.60	146.	74.00	31.21	196.	62.00	-999.99
47.	50.00	90.00	97.	60.00	90.00	147.	78.27	28.63	197.	62.00	-999.99
48.	50.00	90.00	98.	60.00	90.00	148.	80.00	17.05	198.	62.00	41.64
49.	50.00	90.00	99.	60.00	95.82	149.	80.00	5.48	199.	62.00	59.65

CYCLE #246 644 805

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SEC	% RPM	% POWER	SEC	% RPM	% POWER	SEC	% RPM	% POWER
200.	62.00	75.21	250.	68.00	70.00	300.	58.66	67.95
201.	62.00	76.36	251.	69.00	70.00	301.	37.27	60.00
202.	62.00	80.00	252.	70.00	70.00	302.	34.96	60.00
203.	62.00	80.00	253.	70.00	70.00	303.	32.65	73.54
204.	62.00	80.00	254.	70.00	70.00	304.	30.33	80.00
205.	62.00	80.00	255.	70.00	70.00	305.	28.02	80.00
206.	61.15	80.00	256.	70.00	70.00	306.	25.70	50.00
207.	60.00	80.00	257.	70.00	70.00	307.	23.39	37.76
208.	60.00	87.38	258.	73.61	70.00	308.	21.07	10.00
209.	60.00	90.00	259.	76.00	62.41	309.	18.76	10.00
210.	60.00	90.00	260.	76.00	60.00	310.	14.89	MOTORING
211.	60.00	90.00	261.	76.00	100.00	311.	12.13	MOTORING
212.	60.00	90.00	262.	76.92	100.00	312.	5.45	MOTORING
213.	60.00	90.00	263.	80.78	100.00	313.	0.0	0.0
214.	60.00	83.17	264.	82.00	100.00	314.	0.0	0.0
215.	60.00	80.00	265.	83.40	100.00	315.	0.0	0.0
216.	60.00	89.97	266.	84.00	100.00	316.	0.0	0.0
217.	62.31	90.00	267.	83.97	90.00			
218.	64.00	86.88	268.	82.35	90.00			
219.	64.00	80.00	269.	85.33	93.31			
220.	64.00	80.00	270.	89.95	100.00			
221.	64.00	80.00	271.	88.13	100.00			
222.	64.00	80.00	272.	89.21	100.00			
223.	66.00	70.00	273.	95.76	100.00			
224.	66.51	70.00	274.	100.23	100.00			
225.	68.00	65.87	275.	102.00	100.00			
226.	64.00	60.00	276.	104.59	100.00			
227.	68.00	60.00	277.	112.71	100.00			
228.	73.31	86.55	278.	113.01	100.00			
229.	74.00	90.00	279.	112.00	100.00			
230.	74.00	90.00	280.	104.00	MOTORING			
231.	73.29	90.00	281.	103.56	MOTORING			
232.	72.00	84.86	282.	102.75	MOTORING			
233.	73.34	73.29	283.	102.94	MOTORING			
234.	74.00	70.00	284.	99.24	MOTORING			
235.	72.03	70.00	285.	94.61	MOTORING			
236.	71.71	50.00	286.	93.99	MOTORING			
237.	70.00	50.00	287.	92.32	MOTORING			
238.	70.00	50.00	288.	93.36	MOTORING			
239.	69.77	56.15	289.	92.00	MOTORING			
240.	68.00	60.00	290.	90.73	MOTORING			
241.	68.00	60.00	291.	88.42	MOTORING			
242.	68.00	58.28	292.	84.21	MOTORING			
243.	68.00	40.00	293.	82.00	10.00			
244.	68.00	48.01	294.	82.00	7.38			
245.	68.00	60.00	295.	82.00	MOTORING			
246.	68.00	60.00	296.	82.00	MOTORING			
247.	68.00	60.00	297.	68.79	48.69			
248.	68.00	60.00	298.	64.00	70.00			
249.	68.00	61.87	299.	64.00	70.00			

CYCLE # 211024 8101

LOS ANGELES - All Diesel

NON-FREEWAY

SEC	% RPM	% POWER
0.	0.0	0.0
1.	0.0	0.0
2.	0.0	0.0
3.	0.0	0.0
4.	0.0	0.0
5.	0.0	0.0
6.	0.0	0.0
7.	0.0	0.0
8.	0.0	0.0
9.	0.0	0.0
10.	0.0	0.0
11.	0.0	0.0
12.	0.0	0.0
13.	0.0	0.0
14.	0.0	0.0
15.	0.0	0.0
16.	0.0	0.0
17.	0.0	0.0
18.	0.0	0.0
19.	0.0	0.0
20.	0.0	0.0
21.	0.0	0.0
22.	0.0	0.0
23.	0.0	0.0
24.	0.0	15.55
25.	0.0	20.00
26.	24.18	19.08
27.	23.00	10.00
28.	11.56	1.86
29.	6.87	MOTORING
30.	6.00	MOTORING
31.	0.72	MOTORING
32.	0.0	0.0
33.	0.0	0.0
34.	0.0	0.0
35.	0.0	0.0
36.	0.0	0.0
37.	0.0	0.0
38.	0.0	0.0
39.	0.0	0.0
40.	0.0	0.0
41.	0.0	0.0
42.	0.0	0.0
43.	0.0	0.0
44.	0.0	0.0
45.	0.0	0.0
46.	0.0	0.0
47.	0.0	0.0
48.	0.0	0.0
49.	0.0	0.0

SEC	% RPM	% POWER
50.	0.0	0.0
51.	0.0	0.0
52.	0.0	0.0
53.	0.0	0.0
54.	0.0	0.0
55.	0.0	0.0
56.	0.0	0.0
57.	0.0	0.0
58.	0.0	0.0
59.	0.0	0.0
60.	0.0	0.0
61.	0.0	0.0
62.	0.0	0.0
63.	0.0	0.0
64.	0.0	0.0
65.	0.0	0.0
66.	0.0	0.0
67.	0.0	0.0
68.	0.0	0.0
69.	0.0	0.0
70.	0.0	0.0
71.	0.0	0.0
72.	0.0	0.0
73.	0.0	0.0
74.	0.0	0.0
75.	0.0	0.0
76.	0.0	0.0
77.	0.0	0.0
78.	0.0	0.0
79.	0.0	0.0
80.	0.0	29.59
81.	-1.50	87.46
82.	9.88	100.00
83.	46.04	100.00
84.	76.89	100.00
85.	80.00	100.00
86.	82.14	94.64
87.	85.39	81.07
88.	87.70	88.51
89.	92.00	79.83
90.	92.00	61.66
91.	94.58	66.77
92.	102.88	60.00
93.	106.00	72.76
94.	109.18	8.43
95.	111.91	MOTORING
96.	82.00	MOTORING
97.	79.33	MOTORING
98.	71.15	MOTORING
99.	68.84	MOTORING

SEC	% RPM	% POWER
100.	78.35	89.17
101.	82.00	70.00
102.	80.65	69.46
103.	92.85	60.00
104.	97.48	60.00
105.	98.95	60.00
106.	100.74	60.00
107.	103.68	43.17
108.	104.00	10.08
109.	80.62	20.00
110.	83.37	20.00
111.	81.06	15.29
112.	80.00	10.00
113.	76.86	MOTORING
114.	74.11	MOTORING
115.	71.60	MOTORING
116.	70.58	MOTORING
117.	79.00	MOTORING
118.	80.29	1.45
119.	80.58	17.30
120.	78.23	11.13
121.	78.45	19.55
122.	84.36	24.16
123.	72.16	80.00
124.	79.10	74.83
125.	90.09	16.04
126.	74.04	MOTORING
127.	68.02	MOTORING
128.	68.53	MOTORING
129.	59.39	MOTORING
130.	63.54	MOTORING
131.	70.00	2.38
132.	73.10	17.76
133.	72.13	MOTORING
134.	67.27	MOTORING
135.	36.03	MOTORING
136.	20.75	MOTORING
137.	11.49	MOTORING
138.	-2.09	MOTORING
139.	-0.73	MOTORING
140.	8.57	60.00
141.	30.55	61.93
142.	67.10	63.00
143.	86.03	39.85
144.	89.33	30.00
145.	91.64	30.00
146.	97.88	10.40
147.	97.73	1.37
148.	96.00	10.00
149.	96.00	0.96

SEC	% RPM	% POWER
150.	96.00	-999.99
151.	85.27	28.34
152.	87.54	30.76
153.	86.16	29.18
154.	88.00	20.00
155.	87.21	20.00
156.	86.00	20.00
157.	87.42	20.00
158.	88.00	11.32
159.	77.84	-999.99
160.	72.00	-999.99
161.	71.32	-999.99
162.	70.00	0.04
163.	70.00	-999.99
164.	74.88	-999.99
165.	74.06	-999.99
166.	67.74	-999.99
167.	66.00	-999.99
168.	64.23	-999.99
169.	62.00	-999.99
170.	55.94	-999.99
171.	54.00	-999.99
172.	66.43	-999.99
173.	75.21	70.00
174.	86.00	54.53
175.	86.00	24.56
176.	88.81	-999.99
177.	90.00	-999.99
178.	105.48	-999.99
179.	74.00	-999.99
180.	73.34	-999.99
181.	71.02	10.00
182.	76.46	29.38
183.	81.61	40.00
184.	78.16	30.39
185.	74.13	26.46
186.	90.00	0.0
187.	90.87	0.0
188.	92.00	-999.99
189.	93.50	-999.99
190.	94.00	-999.99
191.	94.13	-999.99
192.	88.96	-999.99
193.	63.25	-999.99
194.	62.00	-999.99
195.	49.58	45.37
196.	52.49	86.99
197.	64.00	90.00
198.	64.99	90.00
199.	71.93	93.22

CYCLE # 211 024 810 1
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SEC	% RPM	% POWER
200.	78.87	95.21
201.	82.00	83.64
202.	86.76	80.00
203.	93.71	80.00
204.	94.87	80.00
205.	103.60	80.00
206.	101.23	41.89
207.	95.48	24.85
208.	99.00	50.00
209.	99.79	50.00
210.	106.21	46.82
211.	110.84	MOTORING
212.	99.55	MOTORING
213.	70.95	MOTORING
214.	67.27	MOTORING
215.	60.95	MOTORING
216.	49.03	MOTORING
217.	52.31	MOTORING
218.	54.00	MOTORING
219.	65.27	MOTORING
220.	79.00	MOTORING
221.	57.61	MOTORING
222.	42.59	MOTORING
223.	38.81	MOTORING
224.	22.37	MOTORING
225.	3.52	MOTORING
226.	0.0	0.0
227.	-1.46	16.39
228.	-0.23	5.75
229.	0.0	0.0
230.	0.0	0.0
231.	0.0	0.0
232.	0.0	0.0
233.	0.0	0.0
234.	0.0	0.0
235.	0.0	0.0
236.	0.0	0.0
237.	0.0	0.0
238.	0.0	0.0
239.	0.0	0.0
240.	0.0	0.0
241.	0.0	0.0
242.	0.0	0.0
243.	0.0	0.0
244.	0.0	0.0
245.	0.0	0.0
246.	0.0	0.0
247.	0.0	MOTORING
248.	0.0	0.0
249.	-0.75	MOTORING
250.	-0.56	MOTORING
251.	4.00	MOTORING
252.	0.68	MOTORING
253.	0.0	0.0
254.	0.0	0.0
255.	0.0	2.60
256.	0.0	20.00
257.	0.0	20.00
258.	0.0	7.96
259.	0.0	0.0
260.	0.0	0.0
261.	0.0	78.53
262.	1.85	60.00
263.	11.10	63.88
264.	16.00	70.00
265.	30.05	70.00
266.	42.88	70.00
267.	56.10	70.00
268.	63.39	66.52
269.	70.66	59.94
270.	72.98	80.00
271.	77.87	86.46
272.	88.03	90.00
273.	90.00	90.00
274.	92.23	100.00
275.	94.00	100.00
276.	94.86	100.00
277.	96.00	100.00
278.	97.49	100.00
279.	108.84	100.00
280.	110.00	93.92
281.	104.77	MOTORING
282.	87.50	MOTORING
283.	90.00	0.0
284.	91.38	MOTORING
285.	81.84	MOTORING
286.	65.99	MOTORING
287.	63.68	MOTORING
288.	60.73	MOTORING
289.	57.05	MOTORING
290.	53.47	MOTORING
291.	50.42	MOTORING
292.	44.31	MOTORING
293.	37.58	37.91
294.	33.48	20.00
295.	31.16	20.00
296.	28.85	20.00
297.	22.13	20.00
298.	9.31	MOTORING
299.	0.0	0.0
300.	0.0	0.0
301.	0.0	0.0
302.	0.0	0.0
303.	0.0	0.0
304.	0.0	0.0
305.	0.0	0.0

CYCLE # 154934 5415

Los Angeles - All Diesel

FREEWAY

SEC	% RPM	% Power	SEC	% RPM	% Power	SEC	% RPM	% Power	SEC	% RPM	% Power
0.	0.0	0.0	50.	89.00	90.00	100.	84.52	MOTORING	150.	96.00	42.19
1.	0.0	0.0	51.	90.00	90.00	101.	82.21	MOTORING	151.	96.00	42.33
2.	0.0	0.0	52.	89.63	90.00	102.	79.89	MOTORING	152.	96.00	40.00
3.	0.0	0.0	53.	88.68	90.00	103.	77.58	MOTORING	153.	96.00	38.37
4.	2.52	6.30	54.	90.00	90.00	104.	76.00	6.31	154.	96.00	12.83
5.	10.30	17.87	55.	90.00	90.00	105.	79.16	0.0	155.	96.00	-999.99
6.	13.89	20.00	56.	91.63	81.86	106.	75.16	27.36	156.	96.00	-999.99
7.	20.20	20.00	57.	92.00	80.00	107.	72.00	40.00	157.	96.00	-999.99
8.	24.07	22.59	58.	90.00	81.29	108.	72.00	40.00	158.	97.78	7.37
9.	33.33	17.50	59.	89.43	92.86	109.	74.00	38.44	159.	100.05	19.74
10.	40.30	MOTORING	60.	87.11	100.00	110.	74.00	30.00	160.	102.00	11.83
11.	47.85	MOTORING	61.	86.00	100.00	111.	74.00	30.00	161.	102.00	26.81
12.	66.00	7.78	62.	86.00	100.00	112.	74.00	36.28	162.	103.00	49.96
13.	68.00	10.93	63.	89.66	100.00	113.	72.43	47.86	163.	104.00	60.00
14.	67.59	32.04	64.	90.00	99.27	114.	68.23	59.43	164.	102.37	60.00
15.	66.00	40.00	65.	90.46	90.00	115.	73.80	50.00	165.	103.94	60.00
16.	67.08	40.00	66.	92.78	90.00	116.	72.52	50.00	166.	104.00	40.00
17.	68.00	40.00	67.	95.09	90.00	117.	74.00	45.85	167.	104.00	25.75
18.	69.00	48.33	68.	100.22	82.97	118.	72.85	57.19	168.	103.12	-999.99
19.	75.93	99.53	69.	102.00	80.00	119.	76.38	62.70	169.	100.80	-999.99
20.	78.00	100.00	70.	102.00	70.18	120.	81.55	60.00	170.	100.00	-999.99
21.	78.00	100.00	71.	102.00	80.00	121.	80.18	60.00	171.	101.83	44.88
22.	77.07	100.00	72.	97.34	50.07	122.	83.60	60.00	172.	102.00	36.40
23.	76.00	100.00	73.	87.02	MOTORING	123.	83.44	56.40	173.	102.00	-999.99
24.	76.00	100.00	74.	86.00	MOTORING	124.	86.00	50.00	174.	102.00	-999.99
25.	76.00	100.00	75.	73.12	22.19	125.	87.35	50.00	175.	100.91	-999.99
26.	75.63	100.00	76.	75.77	39.62	126.	86.14	50.00	176.	101.40	-999.99
27.	73.00	97.50	77.	75.76	48.80	127.	86.00	40.11	177.	100.28	-999.99
28.	76.81	90.00	78.	75.11	37.23	128.	88.29	61.47	178.	97.97	-999.99
29.	80.26	90.00	79.	78.00	34.34	129.	88.78	63.92	179.	96.00	-999.99
30.	83.44	90.00	80.	80.37	40.00	130.	86.92	50.00	180.	96.00	10.00
31.	84.00	98.79	81.	77.51	47.49	131.	86.76	50.00	181.	96.00	0.23
32.	84.00	100.00	82.	81.44	50.00	132.	87.55	42.24	182.	96.00	-999.99
33.	83.61	100.00	83.	82.13	39.36	133.	88.00	49.14	183.	96.00	-999.99
34.	82.00	100.00	84.	84.00	27.79	134.	86.00	50.91	184.	94.08	-999.99
35.	83.02	94.91	85.	84.00	16.21	135.	86.00	67.45	185.	78.00	-999.99
36.	86.67	90.00	86.	84.00	15.36	136.	86.00	81.88	186.	77.45	-999.99
37.	89.65	90.00	87.	85.39	26.93	137.	87.13	70.00	187.	71.67	28.96
38.	90.00	99.91	88.	86.00	30.00	138.	89.44	77.21	188.	67.18	80.00
39.	89.45	100.00	89.	86.00	30.08	139.	91.76	88.78	189.	66.50	87.48
40.	86.00	100.00	90.	85.67	40.00	140.	90.07	89.65	190.	71.43	90.00
41.	86.00	95.47	91.	84.65	40.00	141.	92.00	80.00	191.	74.13	90.00
42.	87.22	90.00	92.	86.00	35.20	142.	92.70	80.00	192.	75.56	92.20
43.	88.00	90.00	93.	87.28	30.00	143.	94.00	80.00	193.	74.75	100.00
44.	88.00	80.74	94.	89.00	22.05	144.	94.00	80.00	194.	77.07	94.65
45.	88.00	79.17	95.	86.09	MOTORING	145.	94.00	80.00	195.	79.38	83.08
46.	88.00	77.21	96.	83.78	MOTORING	146.	94.00	80.00	196.	80.00	71.51
47.	88.00	100.00	97.	81.47	MOTORING	147.	94.00	81.37	197.	80.01	69.93
48.	88.00	94.45	98.	81.70	MOTORING	148.	94.59	87.05	198.	82.33	58.36
49.	88.00	90.00	99.	85.16	MOTORING	149.	96.00	57.40	199.	84.00	50.00

CYCLE # 159 934 5415
(Page 2)

SEC	% RPM	% POWER	SEC	% RPM	% POWER
200.	84.00	59.58	250.	100.62	13.12
201.	84.00	76.36	251.	98.00	5.01
202.	84.00	80.00	252.	96.68	10.00
203.	84.00	70.49	253.	96.00	MOTORING
204.	82.00	80.00	254.	96.00	MOTORING
205.	81.47	82.66	255.	96.00	MOTORING
206.	80.00	90.00	256.	95.43	MOTORING
207.	77.68	90.00	257.	94.00	MOTORING
208.	74.52	75.24	258.	94.00	MOTORING
209.	77.58	78.96	259.	95.52	5.18
210.	81.89	80.00	260.	97.83	MOTORING
211.	80.42	80.00	261.	98.00	MOTORING
212.	82.00	83.68	262.	98.00	MOTORING
213.	83.05	79.50	263.	97.22	MOTORING
214.	84.00	70.00	264.	96.00	6.35
215.	84.00	61.60	265.	96.00	12.98
216.	84.00	50.03	266.	96.00	10.00
217.	86.00	60.00	267.	95.93	10.00
218.	86.00	60.00	268.	92.00	10.00
219.	86.00	69.39	269.	92.00	10.00
220.	88.51	73.73	270.	92.98	14.89
221.	88.43	70.00	271.	94.00	13.54
222.	88.00	70.00	272.	90.79	42.12
223.	94.00	70.99	273.	88.08	40.40
224.	94.51	80.00	274.	86.23	30.00
225.	95.17	80.00	275.	88.00	32.75
226.	95.14	80.00	276.	87.14	44.32
227.	94.54	90.00	277.	84.82	50.00
228.	94.00	90.00	278.	82.51	50.00
229.	93.00	77.89	279.	82.00	50.00
230.	94.00	31.99	280.	82.12	40.00
231.	94.00	43.57	281.	83.13	35.64
232.	94.00	60.28	282.	80.00	20.00
233.	94.00	63.29	283.	84.26	51.95
234.	94.00	76.57	284.	86.62	66.21
235.	94.00	89.86	285.	84.31	60.00
236.	94.29	90.00	286.	81.99	9.96
237.	97.80	97.00	287.	79.35	1.61
238.	102.91	90.00	288.	75.36	19.56
239.	104.00	73.85	289.	73.05	40.00
240.	104.00	62.28	290.	70.73	8.35
241.	104.00	69.29	291.	68.42	MOTORING
242.	106.00	70.00	292.	47.15	8.95
243.	106.00	62.70	293.	35.79	10.00
244.	106.00	40.00	294.	32.95	7.38
245.	104.89	40.00	295.	29.16	MOTORING
246.	104.00	32.85	296.	16.47	MOTORING
247.	104.00	30.00	297.	2.13	MOTORING
248.	104.00	0.30	298.	0.0	0.0
249.	103.63	11.87	299.	0.0	0.0
			300.	0.0	0.0

CYCLE #8410263
New York - all gasoline
Non-Freeway

Seconds	% RPM	% Power	Seconds	% RPM	% Power	Seconds	% RPM	% Power	Seconds	% RPM	% Power
0.	0.0	0.0	50.	0.0	0.0	100.	42.96	100.00	150.	36.00	-999.99
1.	0.0	0.0	51.	0.0	0.0	101.	45.79	100.00	151.	34.47	-999.99
2.	-2.52	6.30	52.	0.0	0.0	102.	48.11	99.46	152.	32.15	-999.99
3.	-4.22	15.28	53.	0.0	0.0	103.	50.42	90.00	153.	31.67	-999.99
4.	0.0	10.00	54.	0.0	0.0	104.	52.74	75.23	154.	28.48	13.89
5.	0.0	10.00	55.	0.0	0.0	105.	54.00	50.00	155.	32.38	90.00
6.	0.0	10.00	56.	0.0	0.0	106.	44.42	8.96	156.	36.00	90.00
7.	0.0	75.93	57.	0.0	0.0	107.	45.05	MOTORING	157.	41.69	90.00
8.	0.0	32.22	58.	0.0	0.0	108.	46.00	9.99	158.	45.74	90.00
9.	1.67	35.00	59.	0.0	0.0	109.	37.69	MOTORING	159.	49.95	80.00
10.	15.48	29.82	60.	0.0	0.0	110.	31.61	5.68	160.	49.10	80.00
11.	25.46	MOTORING	61.	0.0	0.0	111.	22.94	35.29	161.	50.59	62.97
12.	24.22	MOTORING	62.	0.0	0.0	112.	24.00	8.87	162.	45.99	34.98
13.	23.44	MOTORING	63.	0.0	0.0	113.	20.86	MOTORING	163.	42.76	7.23
14.	12.41	80.00	64.	0.0	0.0	114.	12.45	MOTORING	164.	35.12	-999.99
15.	8.94	83.61	65.	0.0	0.0	115.	6.00	MOTORING	165.	32.06	67.92
16.	7.26	84.42	66.	0.0	0.0	116.	6.52	MOTORING	166.	35.53	62.55
17.	16.70	80.00	67.	0.0	0.0	117.	7.17	MOTORING	167.	46.57	68.60
18.	24.67	63.33	68.	0.0	0.0	118.	2.56	MOTORING	168.	49.77	48.85
19.	0.24	79.81	69.	0.0	0.0	119.	0.0	0.0	169.	52.00	60.00
20.	0.0	8.52	70.	0.0	0.0	120.	0.0	0.0	170.	58.06	60.00
21.	0.0	0.0	71.	0.0	0.0	121.	0.0	0.0	171.	63.66	23.42
22.	0.0	0.0	72.	0.0	0.0	122.	0.0	10.11	172.	64.14	17.84
23.	0.0	0.0	73.	0.0	0.0	123.	4.32	46.40	173.	59.58	3.76
24.	0.0	0.0	74.	0.0	0.0	124.	8.90	45.17	174.	38.00	42.26
25.	0.0	0.0	75.	0.0	0.0	125.	1.95	50.00	175.	39.09	30.00
26.	0.0	0.0	76.	0.0	0.0	126.	3.33	41.69	176.	40.00	30.00
27.	0.0	0.0	77.	0.0	0.0	127.	4.00	89.46	177.	34.85	47.18
28.	0.0	0.0	78.	0.0	0.0	128.	13.76	55.60	178.	32.03	10.33
29.	0.0	0.0	79.	0.0	0.0	129.	26.43	26.96	179.	34.00	33.48
30.	0.0	0.0	80.	0.0	0.0	130.	33.85	6.16	180.	34.00	50.00
31.	0.0	17.59	81.	0.0	0.0	131.	36.00	MOTORING	181.	33.02	20.69
32.	0.0	19.63	82.	0.0	0.0	132.	34.45	MOTORING	182.	25.54	-999.99
33.	0.0	10.00	83.	0.0	0.0	133.	34.00	MOTORING	183.	15.57	-999.99
34.	0.0	10.00	84.	0.0	0.0	134.	35.64	MOTORING	184.	14.00	-999.99
35.	0.0	10.00	85.	0.0	0.0	135.	32.99	27.39	185.	14.47	27.64
36.	0.0	3.34	86.	0.0	0.0	136.	36.00	80.00	186.	18.00	4.49
37.	0.0	0.0	87.	0.0	0.0	137.	41.63	74.37	187.	17.13	-999.99
38.	0.0	0.0	88.	0.0	0.0	138.	60.41	26.76	188.	16.00	-999.99
39.	0.0	0.0	89.	0.0	0.0	139.	48.44	MOTORING	189.	10.02	-999.99
40.	0.0	0.0	90.	0.0	0.0	140.	43.86	MOTORING	190.	9.81	-999.99
41.	0.0	0.0	91.	0.0	0.0	141.	40.39	MOTORING	191.	5.88	-999.99
42.	0.0	0.0	92.	0.0	0.0	142.	38.50	4.01	192.	4.00	-999.99
43.	0.0	0.0	93.	0.0	0.0	143.	35.05	30.00	193.	4.00	-999.99
44.	0.0	0.0	94.	0.0	0.0	144.	40.66	16.70	194.	2.93	-999.99
45.	0.0	0.0	95.	0.0	0.0	145.	43.64	26.45	195.	0.62	-999.99
46.	0.0	0.0	96.	-1.78	44.40	146.	45.96	MOTORING	196.	0.0	-999.99
47.	0.0	0.0	97.	0.0	85.35	147.	47.10	MOTORING	197.	0.0	-999.99
48.	0.0	0.0	98.	4.25	100.00	148.	49.29	MOTORING	198.	0.0	-999.99
49.	0.0	0.0	99.	27.47	100.00	149.	37.10	MOTORING	199.	0.0	-999.99

CYCLE #8410263

(PAGE 2)

SECONDS	% RPM	% POWER	SECONDS	% RPM	% POWER						
200.	0.0	MOTORING	250.	9.31	MOTORING	-0.	-0.00	-0.00	-0.	-0.00	-0.00
201.	0.0	10.00	251.	3.99	MOTORING	-0.	-0.00	-0.00	-0.	-0.00	-0.00
202.	0.0	10.00	252.	0.0	0.0	-0.	-0.00	-0.00	-0.	-0.00	-0.00
203.	0.0	29.02	253.	0.0	0.0	-0.	-0.00	-0.00	-0.	-0.00	-0.00
204.	0.0	27.83	254.	0.0	0.0	-0.	-0.00	-0.00	-0.	-0.00	-0.00
205.	0.0	7.34	255.	0.0	0.0	-0.	-0.00	-0.00	-0.	-0.00	-0.00
206.	0.0	0.0	256.	0.0	0.0	-0.	-0.00	-0.00	-0.	-0.00	-0.00
207.	0.0	0.0	257.	0.0	0.0	-0.	-0.00	-0.00	-0.	-0.00	-0.00
208.	0.0	0.0	258.	0.0	0.0	-0.	-0.00	-0.00	-0.	-0.00	-0.00
209.	0.0	0.0	259.	0.0	0.0	-0.	-0.00	-0.00	-0.	-0.00	-0.00
210.	0.0	0.0	260.	0.0	0.0	-0.	-0.00	-0.00	-0.	-0.00	-0.00
211.	0.0	0.0	261.	0.0	0.0	-0.	-0.00	-0.00	-0.	-0.00	-0.00
212.	0.0	0.0	262.	0.0	0.0	-0.	-0.00	-0.00	-0.	-0.00	-0.00
213.	0.0	0.0	263.	0.0	0.0	-0.	-0.00	-0.00	-0.	-0.00	-0.00
214.	0.0	0.0	264.	0.0	MOTORING	-0.	-0.00	-0.00	-0.	-0.00	-0.00
215.	0.0	0.0	265.	0.0	MOTORING	-0.	-0.00	-0.00	-0.	-0.00	-0.00
216.	0.0	0.0	266.	0.0	0.0	-0.	-0.00	-0.00	-0.	-0.00	-0.00
217.	2.00	0.0	267.	0.0	0.0	-0.	-0.00	-0.00	-0.	-0.00	-0.00
218.	1.38	0.0	268.	0.0	0.0	-0.	-0.00	-0.00	-0.	-0.00	-0.00
219.	0.0	0.0	269.	0.0	0.0	-0.	-0.00	-0.00	-0.	-0.00	-0.00
220.	0.0	6.27	270.	0.0	0.0	-0.	-0.00	-0.00	-0.	-0.00	-0.00
221.	0.0	2.16	271.	0.0	0.0	-0.	-0.00	-0.00	-0.	-0.00	-0.00
222.	0.0	0.0	272.	0.0	0.0	-0.	-0.00	-0.00	-0.	-0.00	-0.00
223.	0.0	0.0	-0.	0.00	0.00	-0.	-0.00	-0.00	-0.	-0.00	-0.00
224.	0.0	0.0	-0.	-0.00	-0.00	-0.	-0.00	-0.00	-0.	-0.00	-0.00
225.	0.83	MOTORING	-0.	-0.00	-0.00	-0.	-0.00	-0.00	-0.	-0.00	-0.00
226.	2.00	MOTORING	-0.	-0.00	-0.00	-0.	-0.00	-0.00	-0.	-0.00	-0.00
227.	0.54	MOTORING	-0.	-0.00	-0.00	-0.	-0.00	-0.00	-0.	-0.00	-0.00
228.	0.0	MOTORING	-0.	-0.00	-0.00	-0.	-0.00	-0.00	-0.	-0.00	-0.00
229.	0.0	MOTORING	-0.	-0.00	-0.00	-0.	-0.00	-0.00	-0.	-0.00	-0.00
230.	0.0	MOTORING	-0.	-0.00	-0.00	-0.	-0.00	-0.00	-0.	-0.00	-0.00
231.	0.0	MOTORING	-0.	-0.00	-0.00	-0.	-0.00	-0.00	-0.	-0.00	-0.00
232.	0.0	0.0	-0.	-0.00	-0.00	-0.	-0.00	-0.00	-0.	-0.00	-0.00
233.	0.0	0.0	-0.	-0.00	-0.00	-0.	-0.00	-0.00	-0.	-0.00	-0.00
234.	0.0	0.0	-0.	-0.00	-0.00	-0.	-0.00	-0.00	-0.	-0.00	-0.00
235.	0.0	0.0	-0.	-0.00	-0.00	-0.	-0.00	-0.00	-0.	-0.00	-0.00
236.	0.0	0.0	-0.	-0.00	-0.00	-0.	-0.00	-0.00	-0.	-0.00	-0.00
237.	0.0	MOTORING	-0.	-0.00	-0.00	-0.	-0.00	-0.00	-0.	-0.00	-0.00
238.	0.0	22.01	-0.	-0.00	-0.00	-0.	-0.00	-0.00	-0.	-0.00	-0.00
239.	1.23	72.29	-0.	-0.00	-0.00	-0.	-0.00	-0.00	-0.	-0.00	-0.00
240.	6.63	80.00	-0.	-0.00	-0.00	-0.	-0.00	-0.00	-0.	-0.00	-0.00
241.	17.29	89.29	-0.	-0.00	-0.00	-0.	-0.00	-0.00	-0.	-0.00	-0.00
242.	22.17	90.00	-0.	-0.00	-0.00	-0.	-0.00	-0.00	-0.	-0.00	-0.00
243.	24.00	82.70	-0.	-0.00	-0.00	-0.	-0.00	-0.00	-0.	-0.00	-0.00
244.	24.00	31.96	-0.	-0.00	-0.00	-0.	-0.00	-0.00	-0.	-0.00	-0.00
245.	24.00	MOTORING	-0.	-0.00	-0.00	-0.	-0.00	-0.00	-0.	-0.00	-0.00
246.	22.57	MOTORING	-0.	-0.00	-0.00	-0.	-0.00	-0.00	-0.	-0.00	-0.00
247.	22.00	MOTORING	-0.	-0.00	-0.00	-0.	-0.00	-0.00	-0.	-0.00	-0.00
248.	13.88	MOTORING	-0.	-0.00	-0.00	-0.	-0.00	-0.00	-0.	-0.00	-0.00
249.	10.00	MOTORING	-0.	-0.00	-0.00	-0.	-0.00	-0.00	-0.	-0.00	-0.00

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CYCLE #7920435 35

New York - All Gasoline

FREEWAY

NOTE: SEE THE ADDENDUM TO THIS REPORT FOR EXPLANATION OF DELETION

SECOND	% RPM	% POWER
0.	0.0	0.0
1.	0.0	0.0
2.	0.0	0.0
3.	0.0	0.0
4.	0.0	0.0
5.	0.0	0.0
6.	0.0	0.0
7.	0.0	0.0
8.	0.0	0.0
9.	0.0	0.0
10.	0.0	0.0
11.	0.0	0.0
12.	0.0	0.0
13.	0.0	0.0
14.	0.0	0.0
15.	1.44	0.0
16.	8.15	10.37
17.	14.70	20.00
18.	21.00	20.00
19.	23.98	10.09
20.	26.30	4.81
21.	29.93	90.00
22.	35.85	90.00
23.	39.24	90.00
24.	40.00	82.22
25.	40.00	80.00
26.	40.18	80.00
27.	42.00	80.00
28.	42.81	80.00
29.	44.00	63.06
30.	44.00	71.66
31.	44.00	80.00
32.	44.00	90.00
33.	43.61	86.12
34.	42.00	70.00
35.	42.00	59.82
36.	42.00	43.34
37.	43.65	31.76
38.	44.00	31.81
39.	44.00	40.00
40.	44.59	45.92
41.	46.00	46.40
42.	46.00	36.11
43.	46.00	47.68
44.	46.00	50.00
45.	48.00	49.17
46.	49.00	35.19
47.	49.00	20.00
48.	49.11	36.65
49.	50.00	57.12
50.	50.00	60.00
51.	50.00	60.00
52.	50.00	60.00
53.	50.00	49.74
54.	50.00	30.00
55.	50.00	23.43
56.	50.00	20.00
57.	50.00	0.57
58.	50.00	MOTORING
59.	50.00	62.86
60.	50.00	65.56
61.	50.00	47.98
62.	53.03	40.00
63.	54.00	21.64
64.	54.15	21.47
65.	56.00	42.31
66.	56.00	46.12
67.	56.00	50.91
68.	56.00	52.97
69.	56.00	41.40
70.	58.00	20.53
71.	58.00	50.00
72.	58.00	46.67
73.	58.00	44.90
74.	58.00	41.53
75.	58.00	40.00
76.	58.00	40.00
77.	60.24	40.00
78.	61.45	40.00
79.	60.00	44.34
80.	58.82	14.50
81.	56.50	MOTORING
82.	57.81	MOTORING
83.	58.00	MOTORING
84.	57.11	MOTORING
85.	54.00	MOTORING
86.	52.93	6.09
87.	52.00	33.87
88.	53.70	65.53
89.	56.00	60.00
90.	56.00	60.00
91.	56.00	47.08
92.	56.00	20.00
93.	57.28	32.76
94.	58.00	40.00
95.	58.00	40.00
96.	60.22	80.00
97.	63.07	77.33
98.	66.00	70.00
99.	67.16	75.82
100.	66.52	87.40
101.	66.00	98.97
102.	67.89	100.00
103.	66.00	100.00
104.	66.00	100.00
105.	66.00	100.00
106.	66.00	100.00
107.	67.68	91.59
108.	68.00	90.00
109.	70.00	80.00
110.	70.00	76.86
111.	70.00	70.00
112.	70.00	70.00
113.	70.00	77.86
114.	71.99	70.57
115.	72.00	67.99
116.	72.00	57.74
117.	72.00	67.54
118.	70.85	15.64
119.	68.54	MOTORING
120.	68.00	MOTORING
121.	67.91	MOTORING
122.	66.00	MOTORING
123.	65.28	11.58
124.	64.00	44.83
125.	64.00	26.51
126.	64.00	11.69
127.	64.00	0.11
128.	62.88	MOTORING
129.	68.00	46.96
130.	69.85	35.39
131.	73.24	30.00
132.	78.00	30.00
133.	75.87	48.67
134.	78.18	50.91
135.	80.00	42.61
136.	79.19	2.17
137.	78.00	31.26
138.	80.88	25.59
139.	82.00	28.78
140.	122.00	39.65
141.	122.39	39.64
142.	124.00	76.50
143.	124.00	70.00
144.	124.00	70.00
145.	128.93	70.00
146.	145.68	70.00
147.	146.55	63.14
148.	150.00	22.95
149.	150.00	30.00
150.	150.00	30.00
151.	130.07	-999.99
152.	120.30	-999.99
153.	120.00	-999.99
154.	121.91	80.00
155.	130.38	80.00
156.	135.11	85.54
157.	138.88	90.00
158.	140.00	90.00
159.	139.95	87.67
160.	137.27	-999.99
161.	131.96	-999.99
162.	128.00	-999.99
163.	126.69	-999.99
164.	124.37	71.29
165.	125.94	99.70
166.	82.00	91.28
167.	82.57	100.00
168.	86.65	100.00
169.	90.00	100.00
170.	90.00	100.00
171.	93.66	100.00
172.	94.00	92.08
173.	94.00	-999.99
174.	94.77	-999.99
175.	96.00	-999.99
176.	94.60	-999.99
177.	92.28	-999.99
178.	91.57	-999.99
179.	66.00	70.00
180.	64.68	70.00
181.	62.98	50.46
182.	64.00	23.54
183.	64.00	-999.99
184.	62.08	-999.99
185.	33.05	-999.99
186.	25.45	-999.99
187.	20.54	-999.99
188.	12.46	-999.99
189.	7.01	-999.99
190.	2.38	-999.99
191.	2.00	0.0
192.	2.44	15.39
193.	8.75	70.00
194.	15.62	70.00
195.	24.00	63.08
196.	25.70	60.00
197.	26.00	59.93
198.	26.00	58.93
199.	26.00	70.35

CYCLE #792043535

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SECOND	%RPM	%POWER	SECONDS	%RPM	%POWER
200.	26.96	50.00	250.	30.62	MOTORING
201.	29.27	50.00	251.	29.00	MOTORING
202.	30.00	50.00	252.	28.68	MOTORING
203.	30.00	40.49	253.	24.74	14.47
204.	34.22	18.91	254.	24.00	10.27
205.	35.47	10.00	255.	24.00	8.70
206.	34.00	5.77	256.	24.00	0.0
207.	36.32	MOTORING	257.	23.11	MOTORING
208.	32.09	4.76	258.	19.59	MOTORING
209.	30.00	1.04	259.	13.45	MOTORING
210.	32.74	90.00	260.	2.84	72.46
211.	46.00	90.00	261.	5.56	77.80
212.	45.26	93.68	262.	0.0	47.69
213.	42.95	100.00	263.	0.78	47.76
214.	43.37	100.00	264.	2.00	21.84
215.	45.68	100.00	265.	2.00	MOTORING
216.	46.00	100.00	266.	2.00	MOTORING
217.	44.00	100.00	267.	0.0	0.0
218.	44.62	96.88	268.	0.0	0.0
219.	54.45	43.05	269.	0.0	0.0
220.	65.25	MOTORING	270.	0.0	0.0
221.	66.00	MOTORING	271.	0.0	0.0
222.	64.12	MOTORING	272.	0.0	0.0
223.	60.00	MOTORING	273.	0.0	0.0
224.	59.49	12.32	274.	0.0	0.0
225.	58.00	MOTORING	275.	0.0	0.0
226.	58.00	MOTORING	276.	0.0	0.0
227.	58.00	MOTORING	277.	0.0	0.0
228.	58.00	MOTORING	278.	0.0	0.0
229.	29.59	MOTORING	279.	0.0	0.0
230.	20.00	30.00	280.	0.0	0.0
231.	20.71	30.00	281.	0.0	0.0
232.	23.03	24.86	282.	0.0	0.0
233.	25.34	40.13	283.	0.0	0.0
234.	24.34	74.85	284.	0.0	0.0
235.	24.00	40.58	285.	0.0	0.0
236.	24.00	70.00	-0.	-0.00	-0.00
237.	24.00	70.00	-0.	-0.00	-0.00
238.	24.91	65.43	-0.	-0.00	-0.00
239.	26.00	66.15	-0.	-0.00	-0.00
240.	29.09	62.28	-0.	-0.00	-0.00
241.	31.96	87.87	-0.	-0.00	-0.00
242.	30.00	90.00	-0.	-0.00	-0.00
243.	30.97	90.00	-0.	-0.00	-0.00
244.	34.00	90.00	-0.	-0.00	-0.00
245.	34.00	90.00	-0.	-0.00	-0.00
246.	34.00	90.00	-0.	-0.00	-0.00
247.	34.00	46.38	-0.	-0.00	-0.00
248.	32.06	20.00	-0.	-0.00	-0.00
249.	33.63	14.40	-0.	-0.00	-0.00

CYCLE # 211 414 744 7
NEW YORK - All Diesel
NON FREEWAY
(PAGE 2)

SEC	% RPM	% POWER	SEC	% RPM	% POWER
200.	0.0	20.00	250.	0.0	0.0
201.	0.0	20.00	251.	0.0	0.0
202.	0.0	4.12	252.	0.0	0.0
203.	0.0	0.0	253.	0.0	73.41
204.	0.0	0.0	254.	0.0	90.00
205.	0.0	0.0	255.	31.30	81.30
206.	0.0	0.0	256.	41.15	90.00
207.	0.0	0.0	257.	44.00	90.00
208.	0.0	0.0	258.	46.41	90.00
209.	0.0	0.0	259.	51.04	82.41
210.	0.0	0.0	260.	66.66	80.00
211.	0.0	0.0	261.	75.03	90.00
212.	0.0	0.0	262.	89.85	90.00
213.	0.0	0.0	263.	96.78	93.88
214.	0.0	0.0	264.	96.91	50.94
215.	0.0	0.0	265.	94.60	17.02
216.	0.0	0.0	266.	99.16	28.60
217.	0.0	0.0	267.	100.00	39.83
218.	0.0	0.0	268.	100.00	30.00
219.	0.0	0.0	269.	100.00	26.69
220.	0.0	0.0	270.	100.98	20.00
221.	0.0	0.0	271.	100.71	20.00
222.	0.0	0.0	272.	100.00	36.06
223.	0.0	20.00	273.	96.16	40.00
224.	0.0	20.00	274.	95.77	30.00
225.	0.0	11.73	275.	94.55	32.75
226.	0.0	0.0	276.	96.86	35.68
227.	0.0	0.0	277.	99.19	30.00
228.	0.0	0.0	278.	100.00	44.93
229.	0.0	0.0	279.	101.81	50.00
230.	0.0	0.0	280.	86.54	MOTORING
231.	0.0	0.0	281.	63.56	MOTORING
232.	0.0	0.0	282.	56.00	MOTORING
233.	0.0	0.0	283.	46.00	MOTORING
234.	0.0	0.0	284.	41.96	45.18
235.	0.0	0.0	285.	38.31	78.47
236.	0.0	0.0	286.	35.98	80.00
237.	0.0	0.0	287.	31.03	80.00
238.	0.0	0.0	288.	25.36	80.00
239.	0.0	0.0	289.	23.05	60.97
240.	0.0	0.0	290.	18.20	27.34
241.	0.0	0.0	291.	12.84	43.71
242.	0.0	0.0	292.	10.10	68.95
243.	0.0	0.0	293.	3.79	68.95
244.	0.0	0.0	294.	1.48	44.28
245.	0.0	0.0	295.	0.0	0.0
246.	0.0	0.0	296.	0.0	0.0
247.	0.0	0.0	297.	0.0	0.0
248.	0.0	0.0			
249.	0.0	0.0			

CYCLE # 211 414 744 7

NEW YORK - All Diesel

NON-FREEWAY

SEC	% RPM	% POWER
0.	0.0	0.0
1.	0.0	0.0
2.	0.0	0.0
3.	0.0	0.0
4.	0.0	0.0
5.	0.0	0.0
6.	0.0	0.0
7.	0.0	0.0
8.	0.0	0.0
9.	0.0	0.0
10.	0.0	0.0
11.	0.0	0.0
12.	0.0	0.0
13.	0.0	0.0
14.	0.0	0.0
15.	0.0	0.0
16.	0.0	0.0
17.	0.0	0.0
18.	0.0	0.0
19.	0.0	0.0
20.	0.0	0.0
21.	0.0	0.0
22.	0.0	0.0
23.	0.0	6.20
24.	0.0	10.00
25.	0.0	10.00
26.	0.0	0.0
27.	0.0	0.0
28.	0.0	0.0
29.	0.0	0.0
30.	0.0	0.0
31.	0.0	0.0
32.	0.0	0.0
33.	0.0	0.0
34.	0.0	0.0
35.	0.0	0.0
36.	0.0	0.0
37.	0.0	0.0
38.	0.0	0.0
39.	0.0	0.0
40.	0.0	0.0
41.	0.0	0.0
42.	0.0	0.0
43.	0.0	0.0
44.	0.0	0.0
45.	0.0	0.0
46.	0.0	0.0
47.	0.0	0.0
48.	0.0	0.0
49.	0.0	0.0
50.	0.0	0.0
51.	0.0	0.0
52.	0.0	0.0
53.	0.0	0.0
54.	0.0	24.97
55.	0.0	17.16
56.	0.0	0.0
57.	0.0	0.0
58.	0.0	0.0
59.	0.0	0.0
60.	0.0	0.0
61.	0.0	0.0
62.	0.0	0.0
63.	0.0	0.0
64.	0.0	3.67
65.	0.0	47.69
66.	3.11	59.41
67.	9.09	84.54
68.	15.62	80.00
69.	31.49	80.00
70.	37.93	79.29
71.	31.20	38.25
72.	21.99	26.67
73.	30.00	15.10
74.	22.23	16.47
75.	19.61	28.05
76.	20.00	20.38
77.	19.33	MOTORING
78.	6.55	MOTORING
79.	15.82	MOTORING
80.	23.63	MOTORING
81.	17.51	MOTORING
82.	14.19	62.52
83.	16.64	69.36
84.	27.77	60.00
85.	37.03	63.79
86.	47.36	75.36
87.	54.77	80.00
88.	57.70	80.00
89.	54.03	79.92
90.	58.00	65.03
91.	58.65	43.23
92.	62.88	50.00
93.	69.83	50.00
94.	72.00	42.05
95.	75.81	40.00
96.	84.22	42.20
97.	83.86	41.28
98.	80.55	MOTORING
99.	80.51	MOTORING
100.	78.00	MOTORING
101.	79.79	MOTORING
102.	80.33	30.58
103.	85.58	42.12
104.	81.78	50.00
105.	78.00	50.00
106.	80.74	43.16
107.	92.10	73.65
108.	88.01	MOTORING
109.	84.00	MOTORING
110.	84.00	MOTORING
111.	81.17	MOTORING
112.	70.46	MOTORING
113.	66.00	13.57
114.	62.23	29.43
115.	64.00	20.00
116.	63.48	17.42
117.	60.34	10.00
118.	56.85	10.00
119.	56.00	MOTORING
120.	52.45	MOTORING
121.	39.91	10.00
122.	36.38	10.00
123.	30.00	10.00
124.	27.93	10.00
125.	26.00	16.74
126.	27.66	3.36
127.	28.00	MOTORING
128.	27.41	MOTORING
129.	20.96	MOTORING
130.	12.15	MOTORING
131.	3.81	MOTORING
132.	0.0	MOTORING
133.	0.0	MOTORING
134.	0.0	0.91
135.	0.0	7.52
136.	0.0	0.0
137.	0.0	0.0
138.	0.0	0.0
139.	0.0	0.0
140.	0.0	0.0
141.	0.0	0.0
142.	0.0	0.0
143.	0.0	0.0
144.	0.0	0.0
145.	0.0	0.0
146.	0.0	0.0
147.	0.0	0.0
148.	0.0	0.0
149.	0.0	0.0
150.	0.0	0.0
151.	0.0	0.0
152.	0.0	0.0
153.	0.0	0.0
154.	0.0	0.0
155.	0.0	0.0
156.	0.0	0.0
157.	0.0	0.0
158.	0.0	0.0
159.	0.0	0.0
160.	0.0	0.0
161.	0.0	0.0
162.	0.0	0.0
163.	0.0	0.0
164.	0.0	0.0
165.	0.0	0.0
166.	0.0	0.0
167.	0.0	0.0
168.	1.77	-999.99
169.	1.60	-999.99
170.	0.0	-999.99
171.	0.0	0.0
172.	2.14	9.28
173.	3.08	0.0
174.	0.0	0.0
175.	0.0	0.0
176.	0.0	0.0
177.	0.0	0.0
178.	0.0	0.0
179.	0.0	0.0
180.	0.0	0.0
181.	0.0	0.0
182.	0.0	0.0
183.	0.0	0.0
184.	0.0	0.0
185.	0.0	0.0
186.	0.0	5.51
187.	0.0	11.34
188.	0.0	0.0
189.	0.0	0.0
190.	0.0	0.0
191.	0.0	0.0
192.	0.0	0.0
193.	0.0	0.0
194.	0.0	0.0
195.	0.0	0.0
196.	0.0	0.0
197.	0.0	0.21
198.	0.0	30.00
199.	0.0	26.78

CYCLE #104 094 544

NEW YORK - All Diesel

FREEWAY

SEC	% RPM	% POWER	SEC	% RPM	% POWER	SEC	% RPM	% POWER	SEC	% RPM	% POWER
0.	0.0	0.0	50.	0.0	0.0	100.	94.00	90.00	150.	75.56	25.63
1.	0.0	MOTORING	51.	0.0	0.0	101.	92.21	98.97	151.	72.47	17.67
2.	0.0	MOTORING	52.	0.0	0.0	102.	90.00	99.46	152.	77.54	-999.99
3.	0.0	0.0	53.	0.0	0.0	103.	90.00	87.88	153.	72.21	-999.99
4.	0.0	0.0	54.	0.0	0.0	104.	90.00	80.00	154.	51.04	62.39
5.	0.0	0.0	55.	0.0	0.0	105.	90.00	80.00	155.	51.17	70.00
6.	0.0	0.0	56.	0.0	0.0	106.	91.37	86.84	156.	56.00	58.93
7.	0.0	0.0	57.	0.0	0.0	107.	90.32	90.00	157.	56.00	50.00
8.	0.0	0.0	58.	0.0	0.0	108.	90.00	99.99	158.	56.00	32.63
9.	0.0	0.0	59.	0.0	0.0	109.	94.31	99.44	159.	54.00	39.74
10.	0.0	0.0	60.	0.0	0.0	110.	96.00	93.14	160.	53.63	37.33
11.	0.0	0.0	61.	0.0	0.0	111.	97.88	100.00	161.	52.00	70.00
12.	0.0	0.0	62.	0.0	0.0	112.	100.00	100.00	162.	52.00	70.00
13.	0.0	0.0	63.	0.0	0.0	113.	100.00	100.00	163.	53.31	37.23
14.	0.0	0.0	64.	0.29	MOTORING	114.	101.89	100.00	164.	54.00	20.00
15.	0.0	0.0	65.	3.54	MOTORING	115.	101.80	100.00	165.	55.94	20.00
16.	0.0	MOTORING	66.	1.22	MOTORING	116.	100.00	97.42	166.	55.74	23.83
17.	0.0	MOTORING	67.	0.0	4.54	117.	100.00	90.00	167.	56.85	44.30
18.	0.0	0.0	68.	0.0	0.0	118.	98.85	95.73	168.	63.12	34.42
19.	0.0	0.0	69.	0.0	0.0	119.	98.00	92.70	169.	62.00	34.00
20.	0.0	0.0	70.	0.0	0.0	120.	98.00	98.87	170.	60.49	30.00
21.	7.33	MOTORING	71.	0.0	0.0	121.	98.00	100.00	171.	60.00	30.00
22.	23.07	MOTORING	72.	0.0	0.0	122.	98.00	100.00	172.	58.14	70.00
23.	19.29	MOTORING	73.	0.0	0.0	123.	98.00	100.00	173.	61.38	72.29
24.	6.67	MOTORING	74.	0.0	0.0	124.	99.03	100.00	174.	52.08	83.87
25.	9.61	MOTORING	75.	0.0	0.0	125.	101.15	100.00	175.	45.24	90.00
26.	0.0	0.92	76.	0.0	0.0	126.	108.65	50.09	176.	59.40	90.00
27.	0.0	7.50	77.	34.00	62.39	127.	106.04	40.00	177.	56.56	90.00
28.	0.0	0.0	78.	35.66	77.23	128.	106.88	45.87	178.	53.90	90.16
29.	0.0	0.0	79.	40.00	61.31	129.	113.22	76.96	179.	48.35	100.00
30.	0.0	0.0	80.	40.00	67.75	130.	107.69	33.08	180.	51.99	96.69
31.	0.0	0.0	81.	47.49	87.49	131.	100.48	MOTORING	181.	56.98	90.00
32.	0.0	0.0	82.	48.19	90.00	132.	92.69	MOTORING	182.	58.00	90.00
33.	0.0	0.0	83.	52.13	90.00	133.	88.13	18.01	183.	58.00	90.00
34.	0.0	0.0	84.	54.00	90.00	134.	90.00	8.18	184.	59.92	80.39
35.	0.0	0.0	85.	52.49	90.00	135.	90.50	MOTORING	185.	62.00	38.82
36.	0.0	0.0	86.	67.15	90.00	136.	89.57	MOTORING	186.	62.00	41.02
37.	0.0	0.0	87.	82.00	96.91	137.	82.62	0.0	187.	62.00	70.00
38.	0.0	0.0	88.	81.70	91.49	138.	81.44	0.0	188.	62.00	52.29
39.	0.0	0.0	89.	84.00	90.00	139.	80.24	8.78	189.	64.99	62.43
40.	0.0	0.0	90.	84.33	90.00	140.	80.14	20.71	190.	67.81	60.95
41.	0.0	0.0	91.	86.00	90.00	141.	84.00	40.00	191.	69.75	51.25
42.	0.0	0.0	92.	86.96	90.00	142.	84.70	50.51	192.	66.44	70.00
43.	0.0	0.0	93.	88.00	96.38	143.	83.97	75.08	193.	67.25	70.00
44.	0.0	0.0	94.	88.00	100.00	144.	83.33	40.10	194.	72.42	27.23
45.	0.0	0.0	95.	88.00	90.47	145.	84.00	20.00	195.	78.00	-999.99
46.	0.0	2.40	96.	88.22	90.00	146.	78.12	39.60	196.	74.60	-999.99
47.	0.0	6.02	97.	90.53	90.00	147.	77.73	37.26	197.	71.97	-999.99
48.	0.0	0.0	98.	92.85	94.25	148.	77.18	25.89	198.	68.33	6.43
49.	0.0	0.0	99.	94.00	94.18	149.	79.10	44.52	199.	70.00	90.00

CYCLE #104 094 549

(Page 2)

200.	70.96	99.00
201.	73.27	70.91
202.	75.59	60.00
203.	91.71	MOTORING
204.	77.13	MOTORING
205.	70.00	0.64
206.	72.54	25.77
207.	76.00	14.19
209.	83.38	17.38
209.	87.79	20.00
210.	90.00	20.53
211.	90.00	27.90
212.	90.00	27.36
213.	90.00	40.00
214.	92.73	67.30
215.	95.68	80.00
216.	96.00	80.00
217.	94.31	80.00
218.	96.00	61.27
219.	94.12	24.70
220.	93.25	48.81
221.	90.85	67.84
222.	93.77	70.00
223.	98.59	70.99
224.	104.00	64.63
225.	104.83	20.00
226.	106.00	14.29
227.	104.54	10.00
228.	99.69	MOTORING
229.	99.83	MOTORING
230.	90.81	MOTORING
231.	67.15	MOTORING
232.	62.00	MOTORING
233.	62.00	MOTORING
234.	59.69	MOTORING
235.	101.37	MOTORING
236.	99.71	MOTORING
237.	91.49	MOTORING
238.	75.09	MOTORING
239.	72.77	MOTORING
240.	70.46	20.87
241.	70.00	39.29
242.	69.93	42.59
243.	69.00	70.00
244.	70.40	74.01
245.	74.00	80.00
246.	78.29	80.00
247.	76.51	80.00
248.	80.06	80.00
249.	82.00	80.00
250.	82.00	80.00
251.	81.00	34.89
252.	81.32	MOTORING
253.	85.26	MOTORING
254.	82.11	MOTORING
255.	81.48	MOTORING
256.	80.57	MOTORING
257.	82.00	MOTORING
258.	79.59	MOTORING
259.	78.00	MOTORING
260.	81.67	MOTORING
261.	80.15	MOTORING
262.	82.46	27.69
263.	81.22	20.00
264.	82.00	14.55
265.	72.17	10.00
266.	74.89	10.00
267.	63.87	10.00
268.	54.61	8.26
269.	48.66	MOTORING
270.	46.09	MOTORING
271.	31.67	MOTORING
272.	13.15	MOTORING
273.	21.52	MOTORING
274.	26.00	MOTORING
275.	26.00	4.51
276.	24.27	MOTORING
277.	19.64	MOTORING
278.	19.49	MOTORING
279.	23.61	MOTORING
280.	24.78	MOTORING
281.	4.69	MOTORING
282.	0.0	MOTORING
283.	0.0	0.0
284.	0.0	0.0
285.	0.0	0.0
286.	0.0	0.0
287.	0.0	0.0
288.	0.0	0.0
289.	0.0	0.0
290.	0.0	0.0
291.	0.0	0.0
292.	0.0	0.0
293.	0.0	0.0
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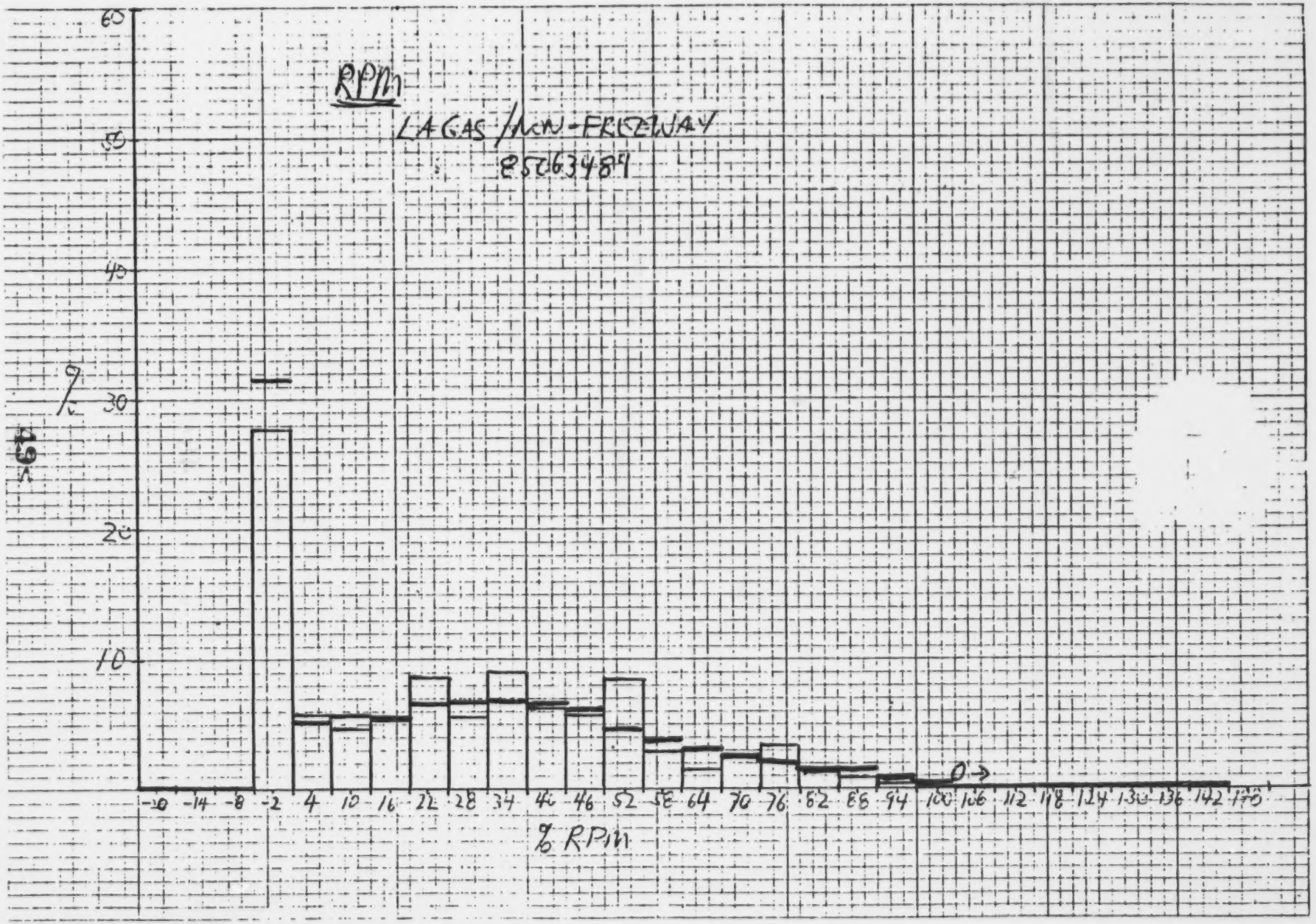
295.	0.0	0.0
296.	0.0	0.0

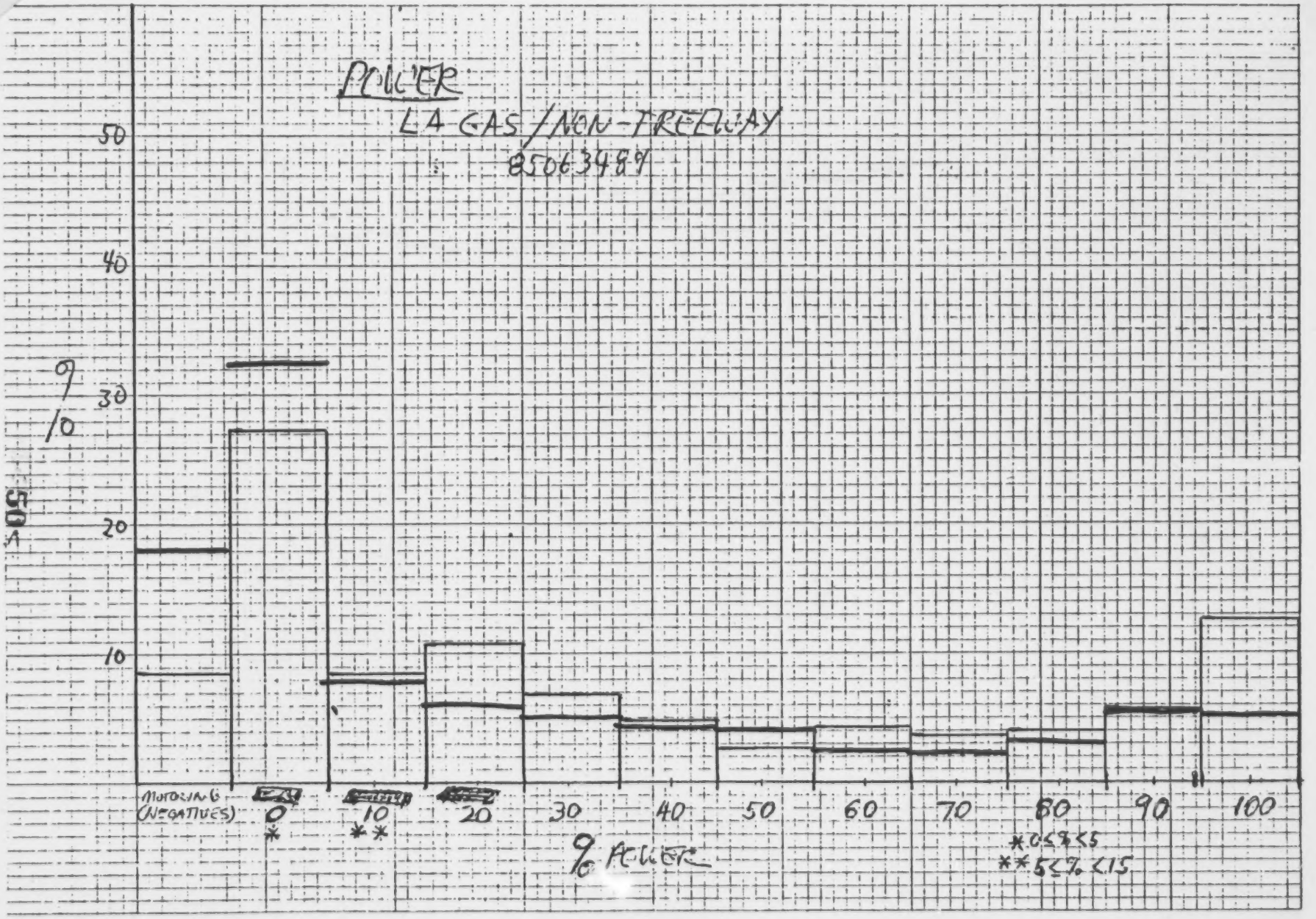
APPENDIX C

Density Plots

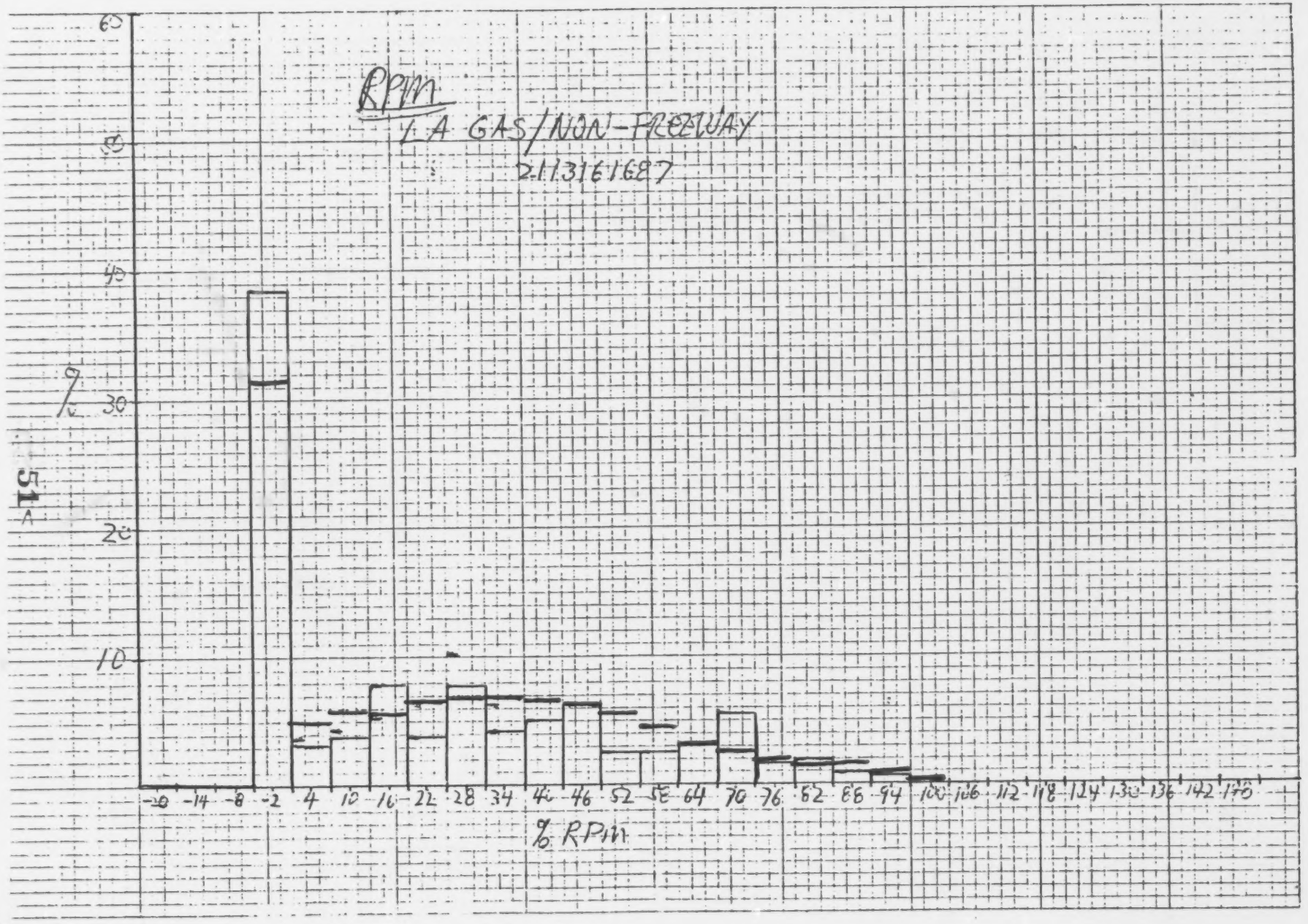
for

Unselected Cycles

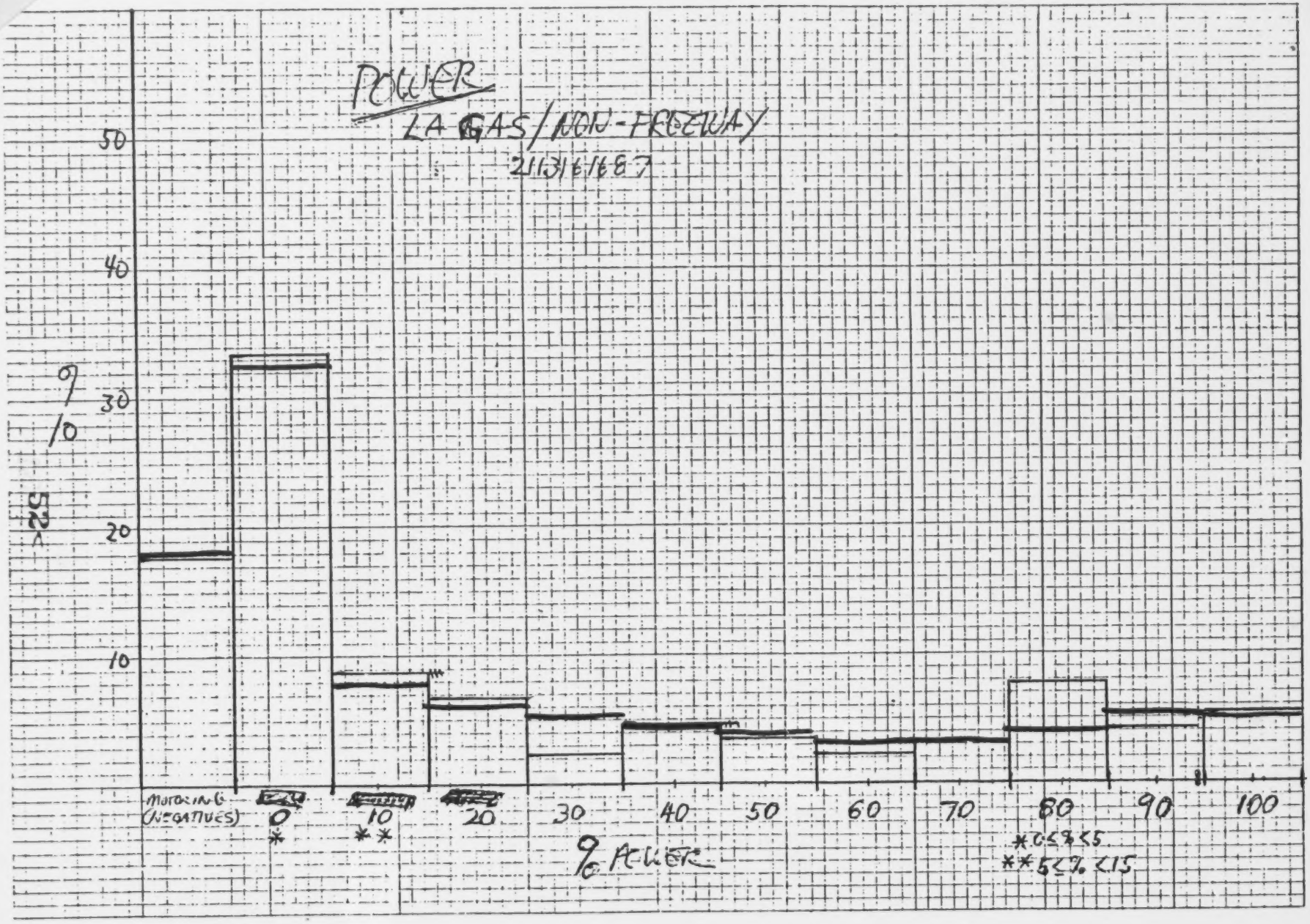

RPM
LAGAS / NON-FREEWAY
85063489
%
60
50
40
30
20
10
-20 -14 -8 -2 4 10 16 22 28 34 40 46 52 58 64 70 76 82 88 94 100 106 112 118 124 130 136 142 148
0 →
% RPM

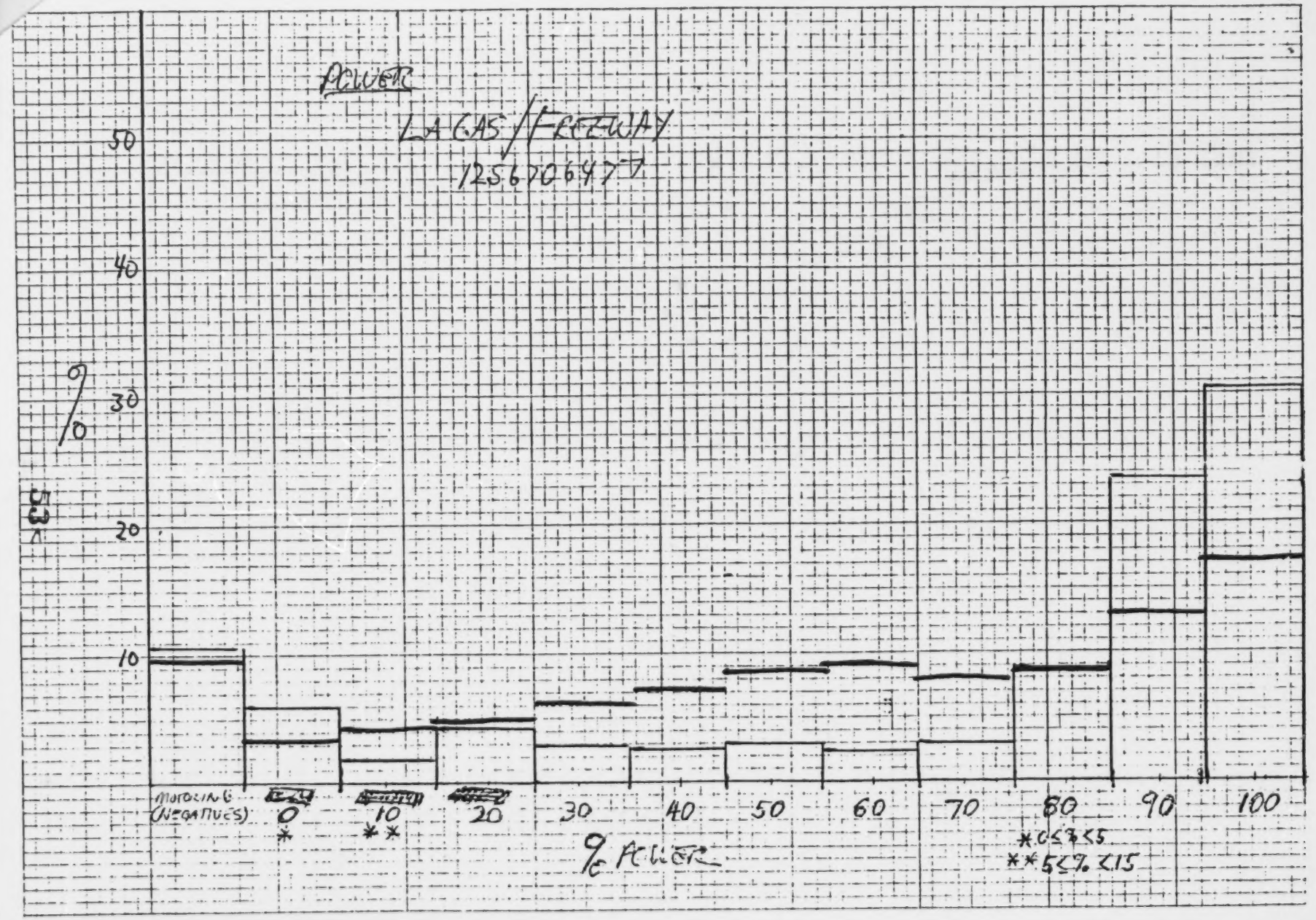

POWER
LA GAS / NON-FREEWAY
85063489
50
40
30
20
10
%
MOTORING (NEGATIVES)
0
10
20
30
40
50
60
70
80
90
100
*
**
% POWER
*0≤%<5
**5≤%<15

50


RPM
LA GAS/NON-FREEWAY
2.11316687
60
50
40
%
30
20
10
-20 -14 -8 -2 4 10 16 22 28 34 40 46 52 58 64 70 76 82 88 94 100 106 112 118 124 130 136 142 148
% RPM

51
A


POWER
LA GAS/NON-FREEWAY
2113161687
%
50
40
30
20
10
MOTORING (NEGATIVES)
0
10
20
30
40
50
60
70
80
90
100
% POWER
*0≤%<5
**5≤%<15


POWER
LA GAS / FREEWAY
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%
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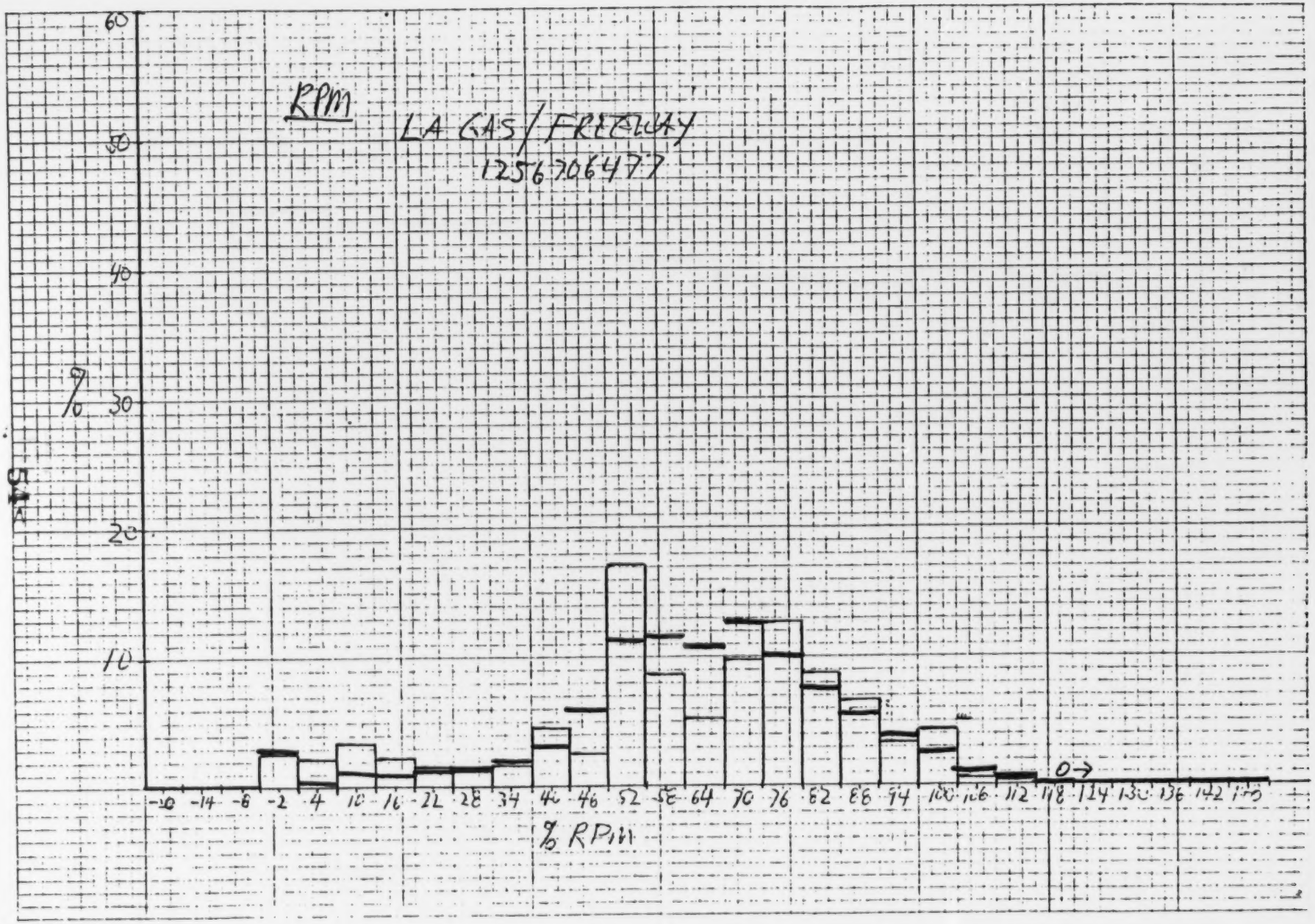
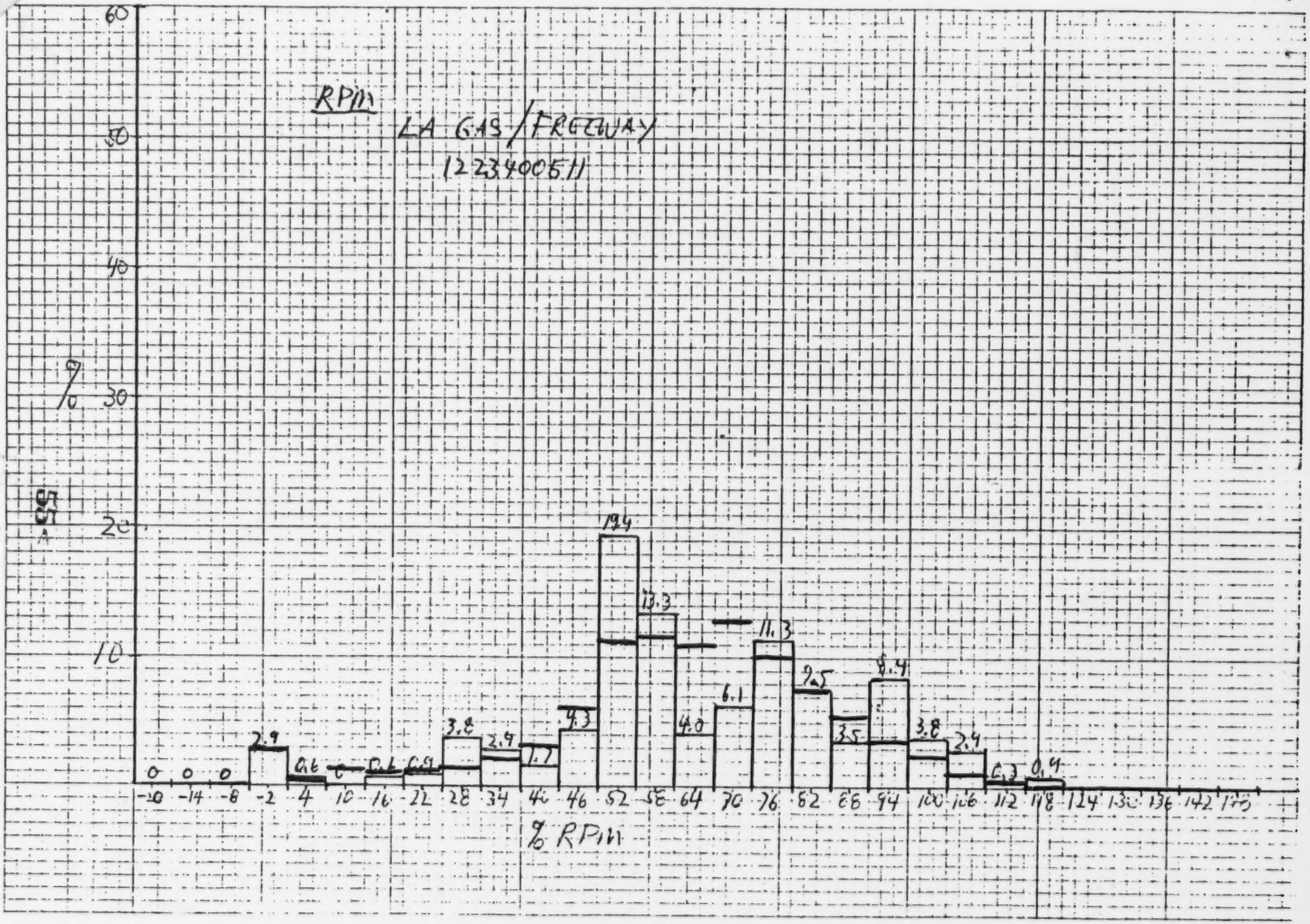
40
30
20
10
MOTORING (NEGATIVES)
0
10
20
30
40
50
60
70
80
90
100
*
**
% POWER
*0≤%<5
**5≤%<15


RPM
LA GAS / FREEWAY
1256 7064 77
60
50
40
%
30
20
10
-10 -14 -8 -2 4 10 16 22 28 34 40 46 52 58 64 70 76 82 88 94 100 106 112 118 124 130 136 142 148
% RPM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LA GAS / FREEWAY
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%
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50
40
30
20
10
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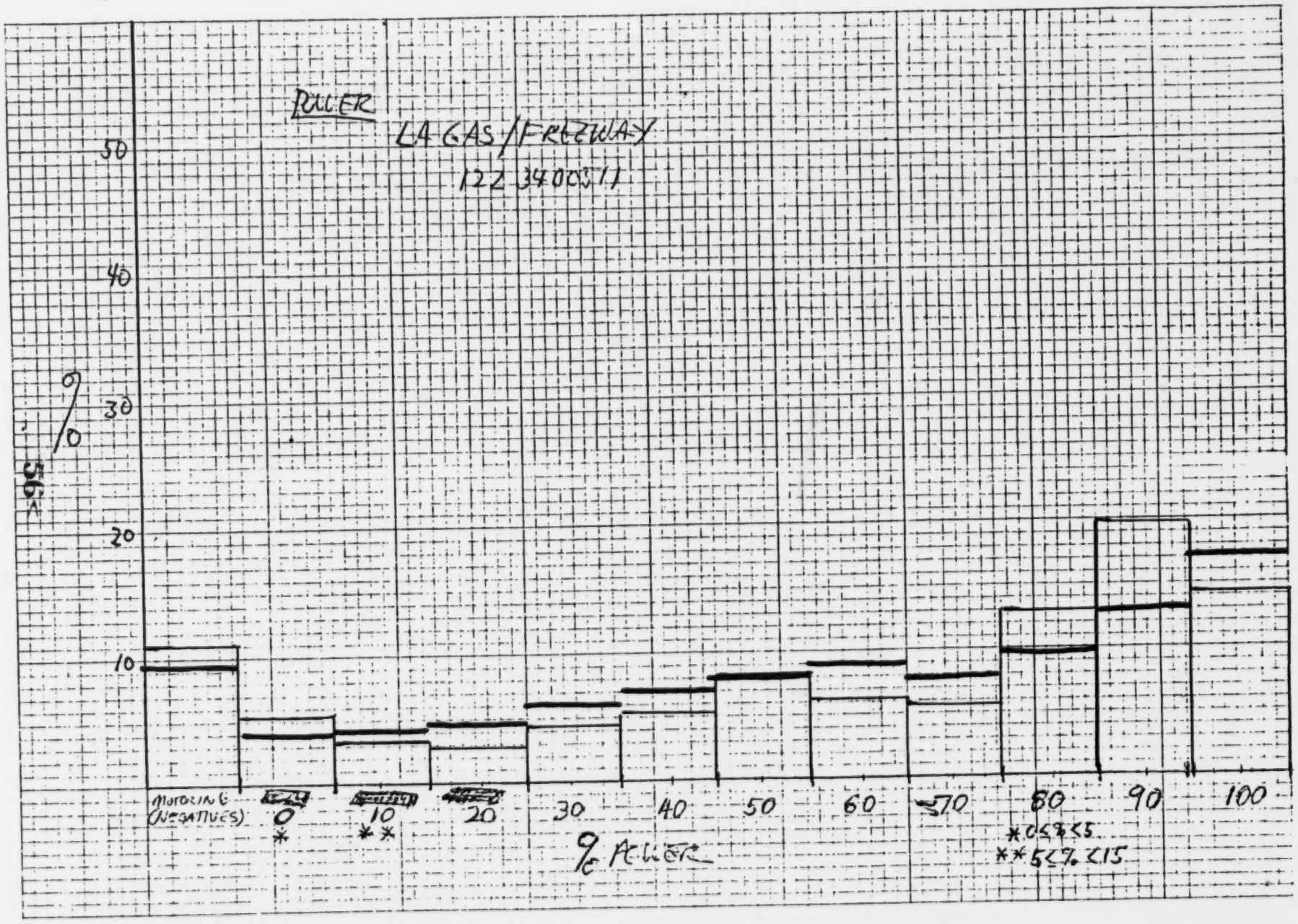
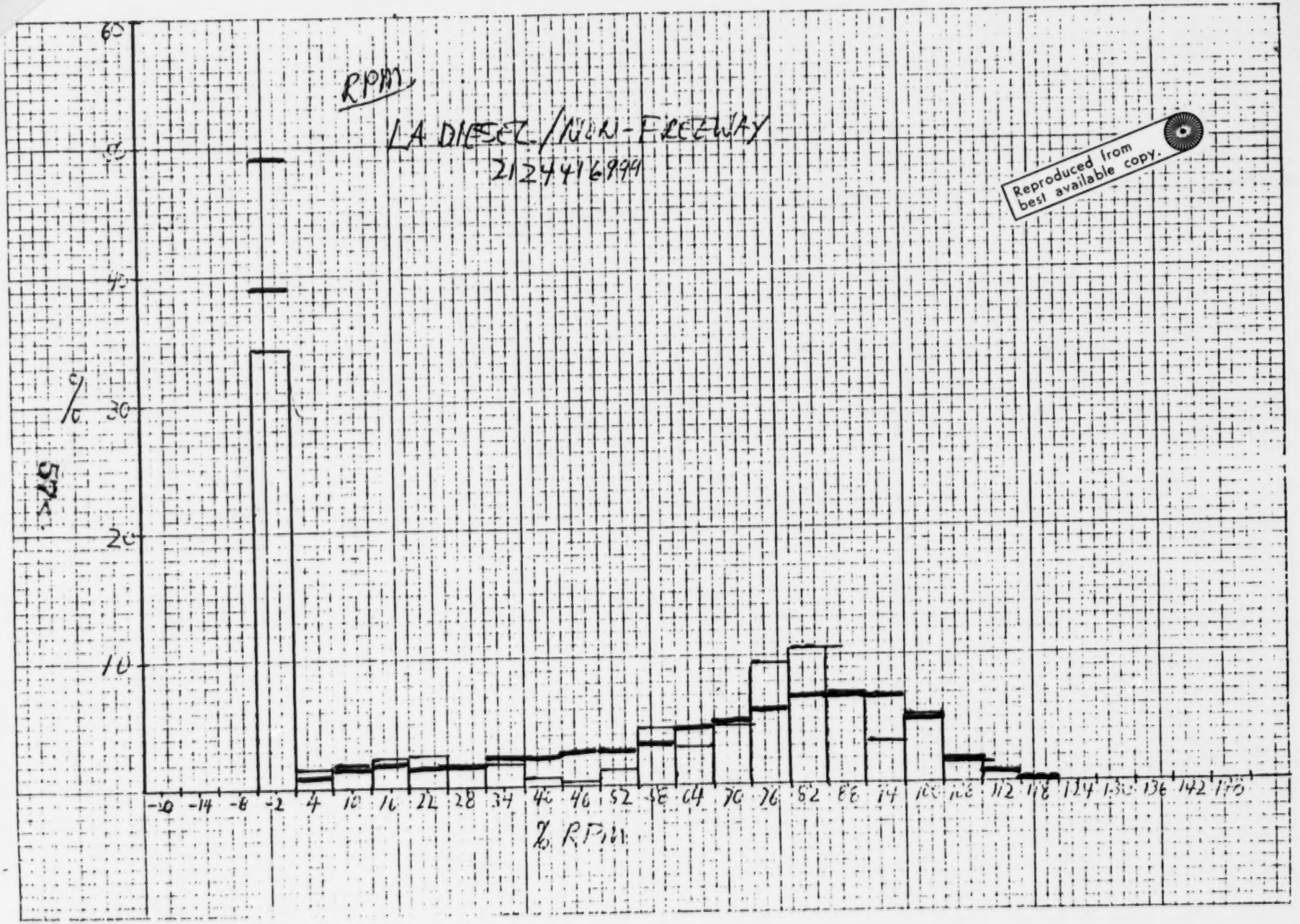
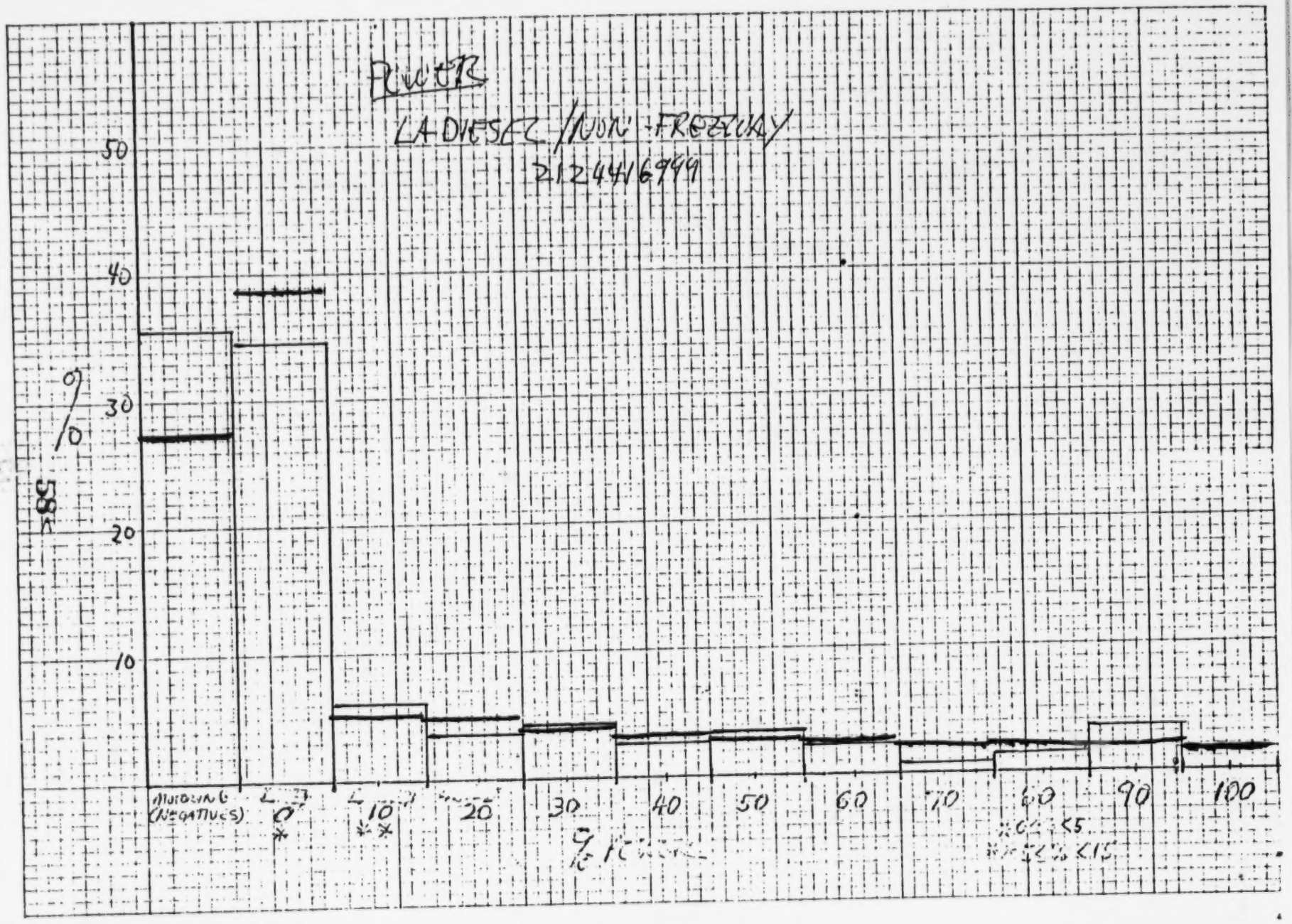
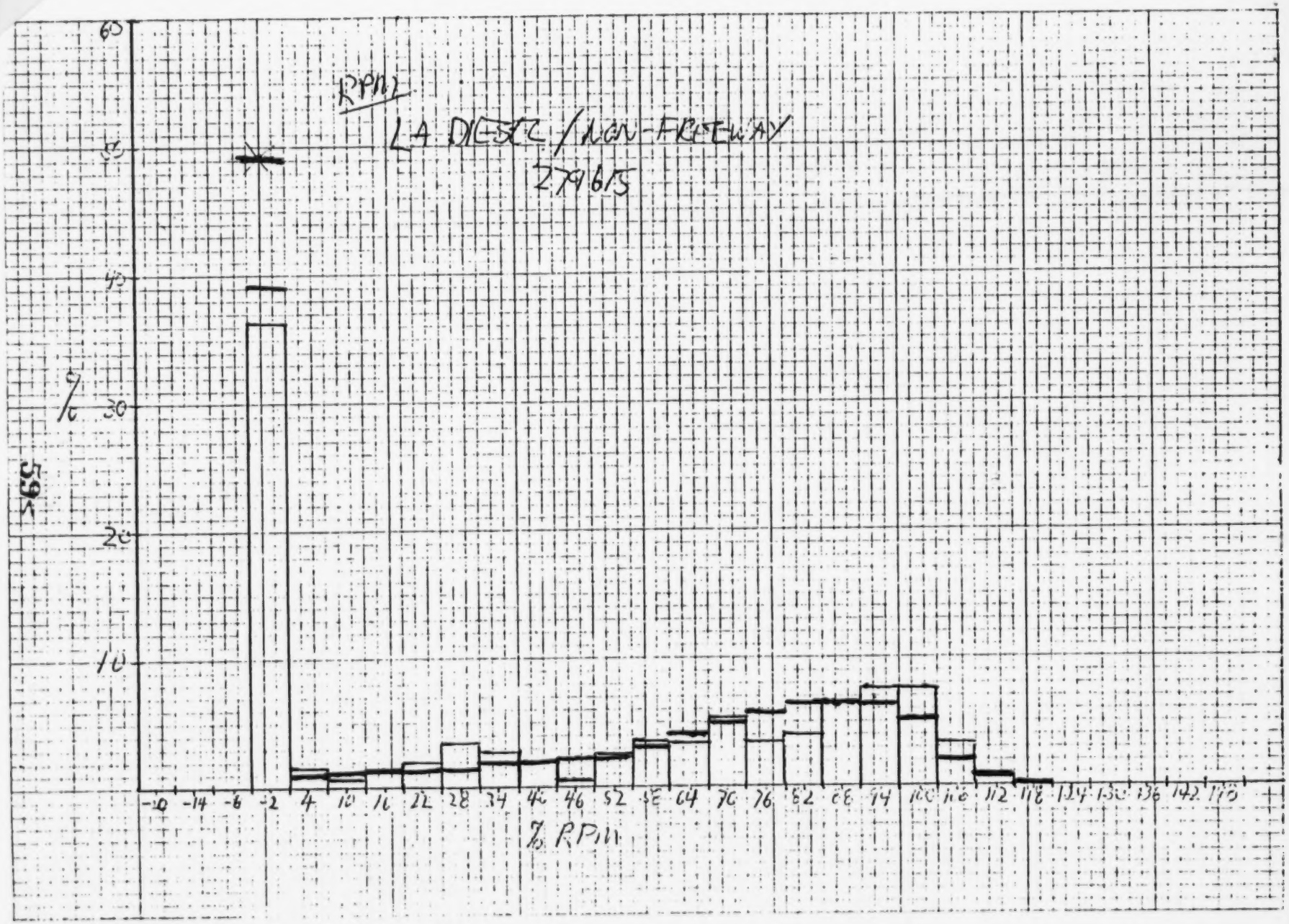
-20 -14 -8 -2 4 10 16 22 28 34 40 46 52 58 64 70 76 82 88 94 100 106 112 118 124 130 136 142 148
% RPM

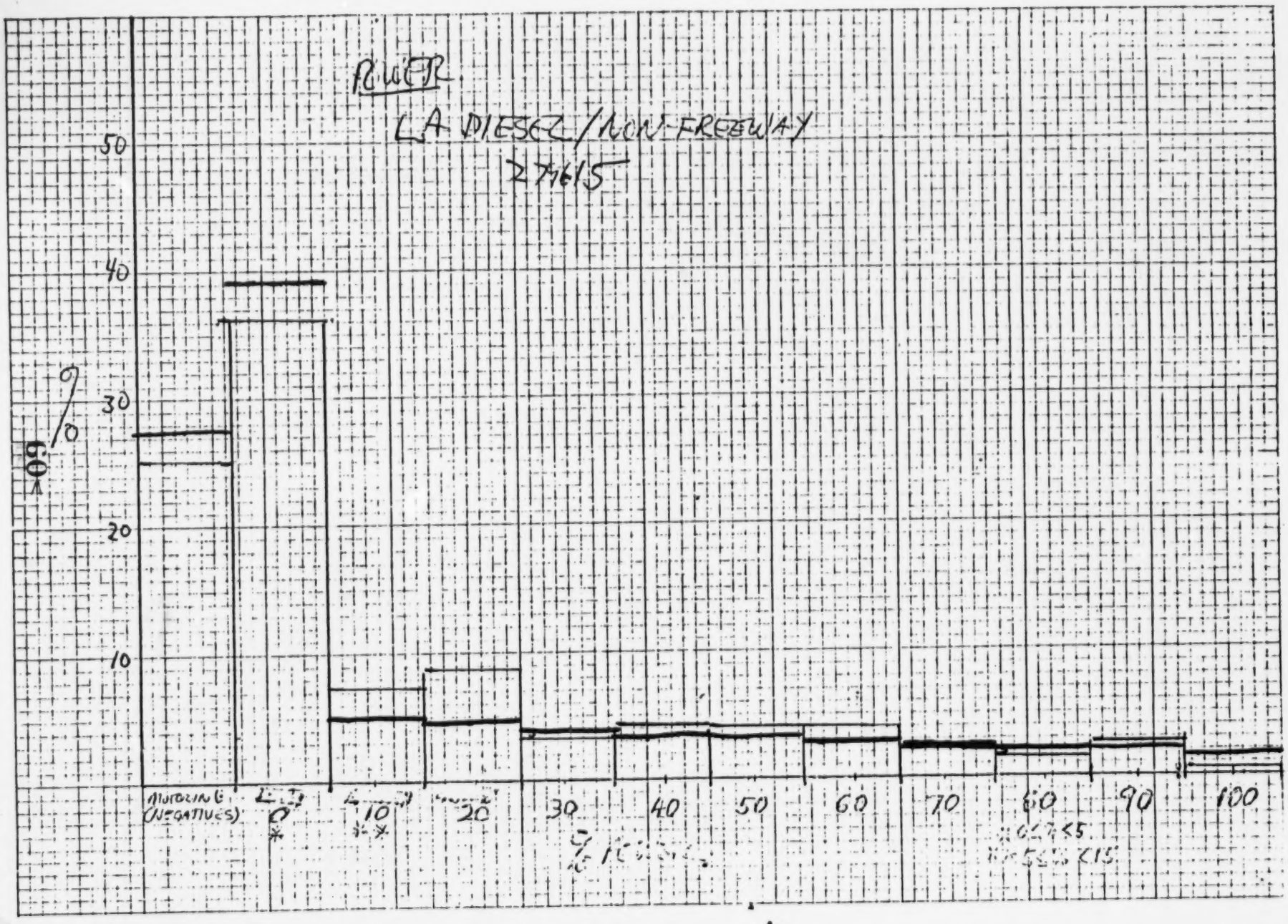

POWER
LA GAS/FREEWAY
122 3400511
50
40
30
20
10
%
MOTORING (NEGATIVES)
0
*
10
**
20
30
40
50
60
70
80
90
100
% POWER
*0≤%<5
**5≤%<15

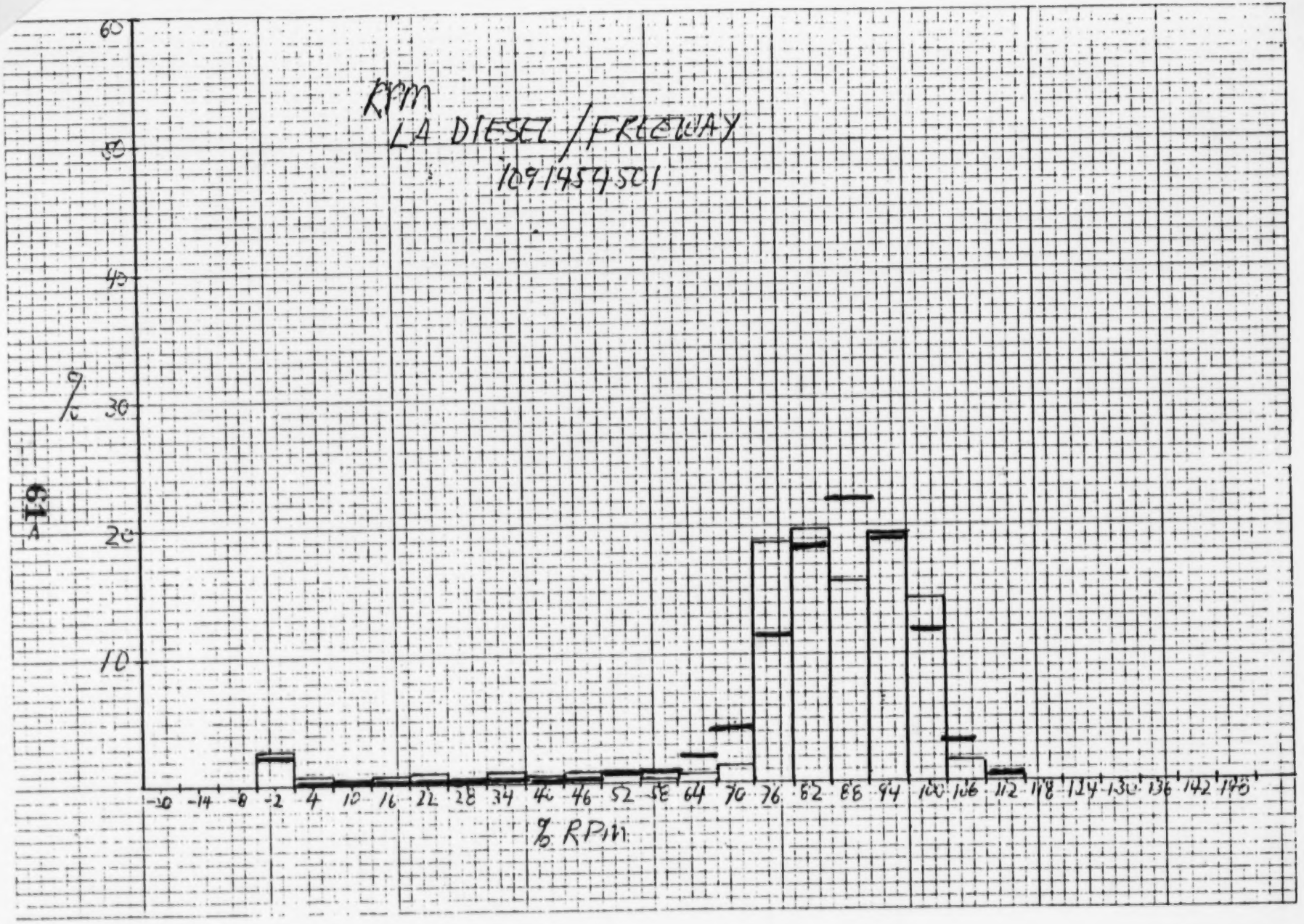

RPM
LA DIESEL/NON-FREEWAY
2124416999
Reproduced from best available copy.
60
40
30
20
10
% TIME
-10 -14 -8 -2 4 10 16 22 28 34 40 46 52 58 64 70 76 82 88 94 100 106 112 118 124 130 136 142 148
% RPM

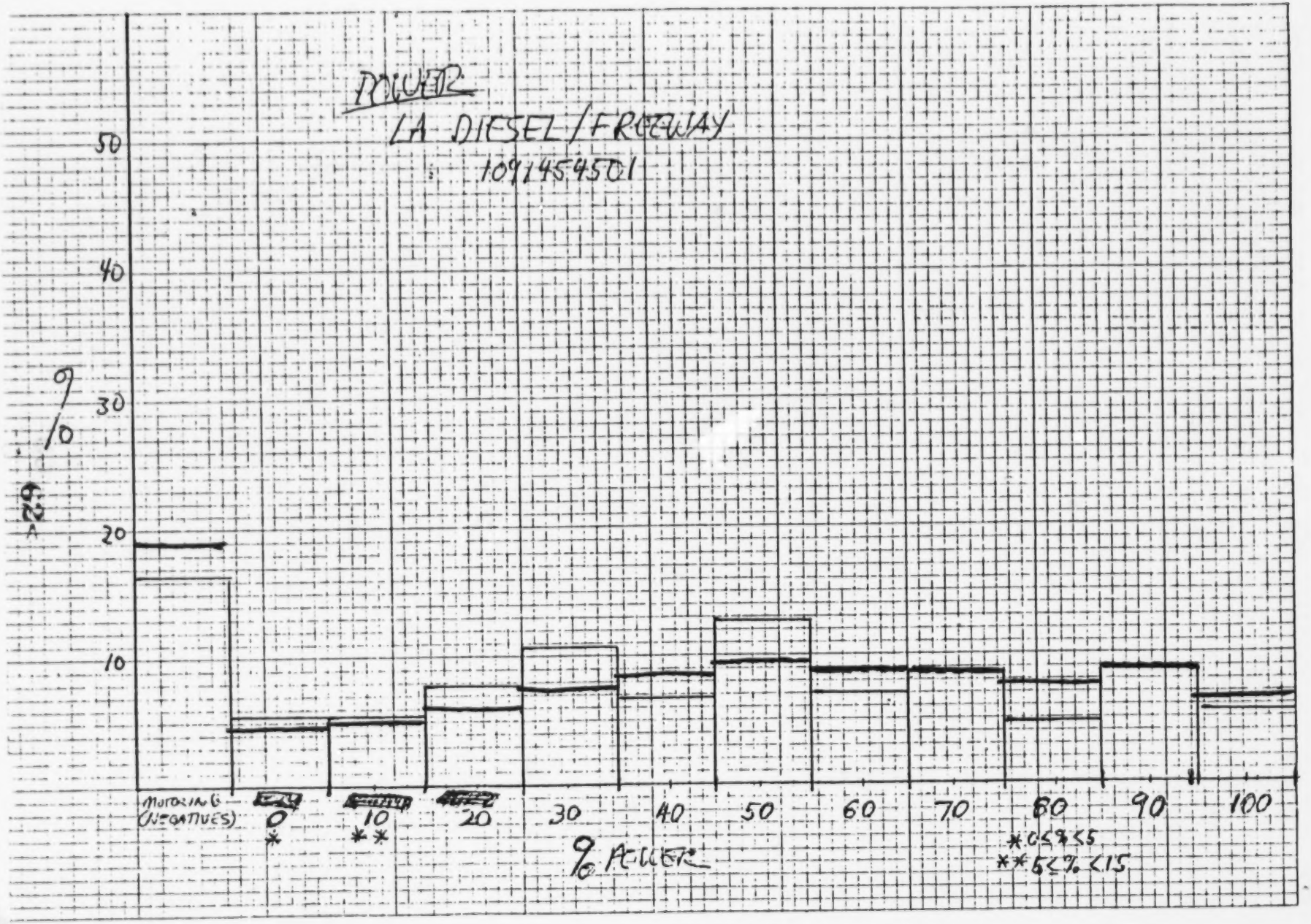

POWER
LA DIESEL / NON-FREEWAY
2124416999
50
40
30
20
10
%
MOTORING (NEGATIVES)
0
10
20
30
40
50
60
70
80
90
100
%

58

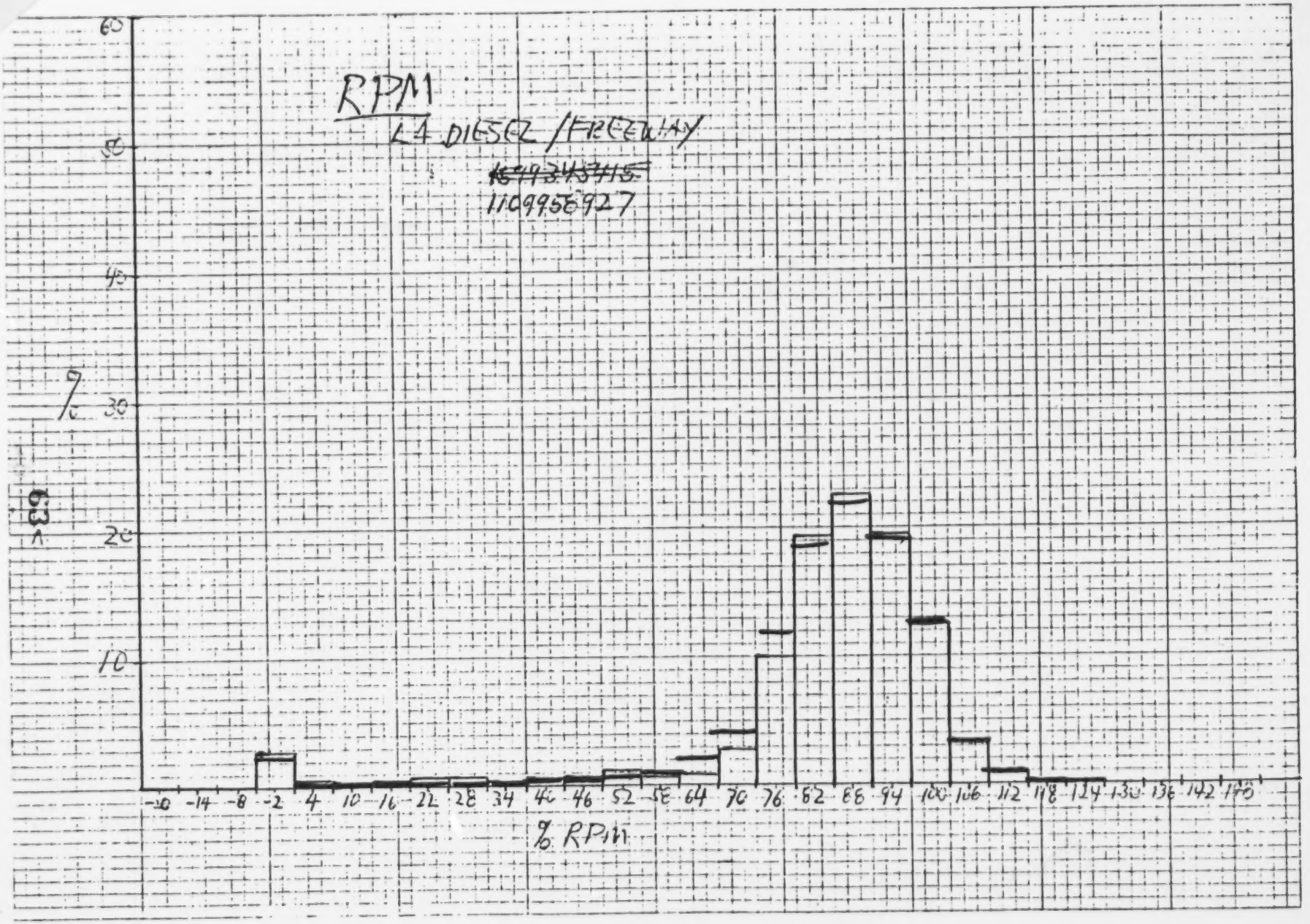

RPM
LA DIESEL / NON-FREEWAY
279615
%
60
50
40
30
20
10
-20 -14 -8 -2 4 10 16 22 28 34 40 46 52 58 64 70 76 82 88 94 100 106 112 118 124 130 136 142 148
% RPM

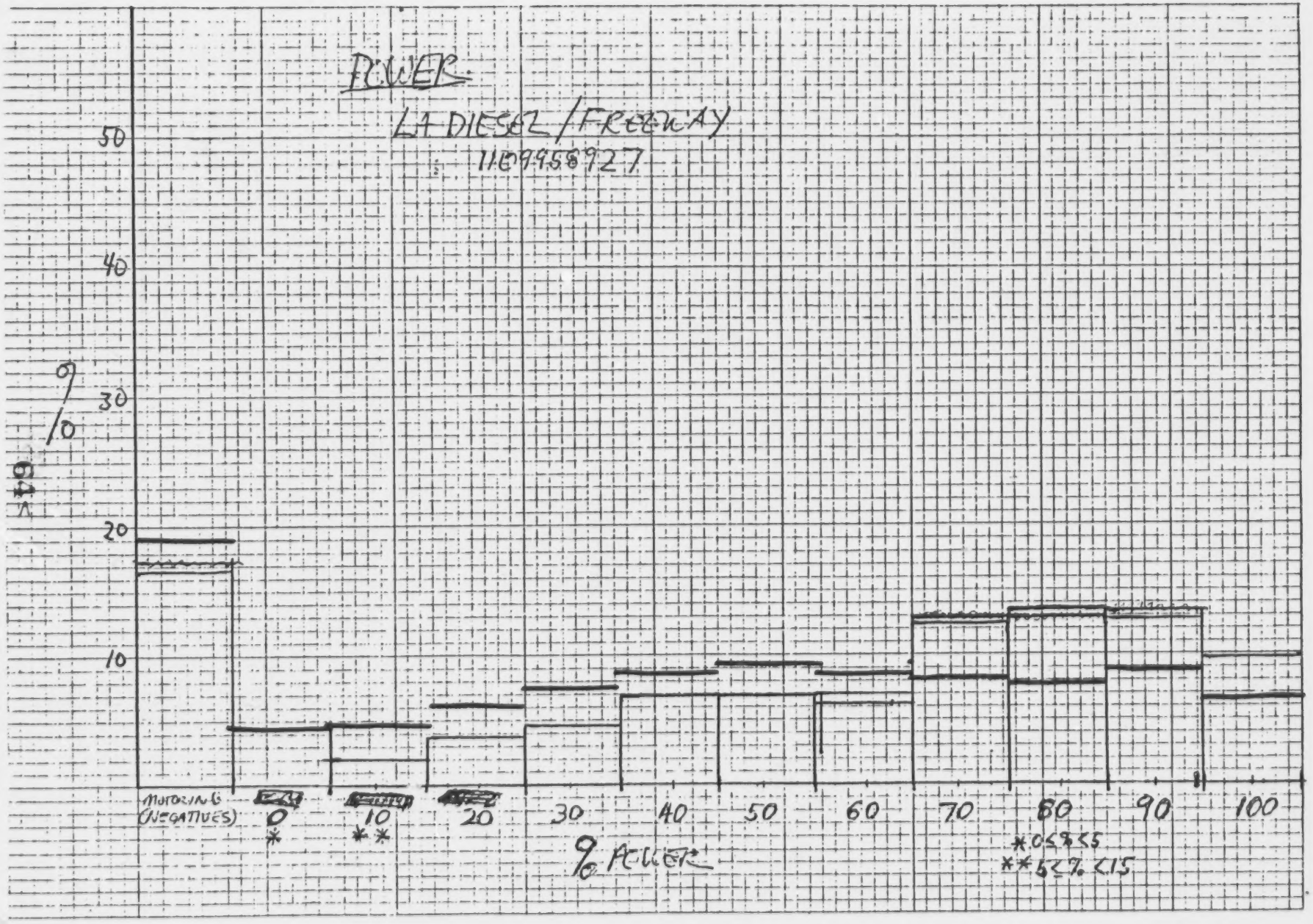

RUFF
LA DIESEL/NON-FREEWAY
27615
50
40
30
20
10
g/10
60
MISSING (NEGATIVES)
0
10
20
30
40
50
60
70
80
90
100

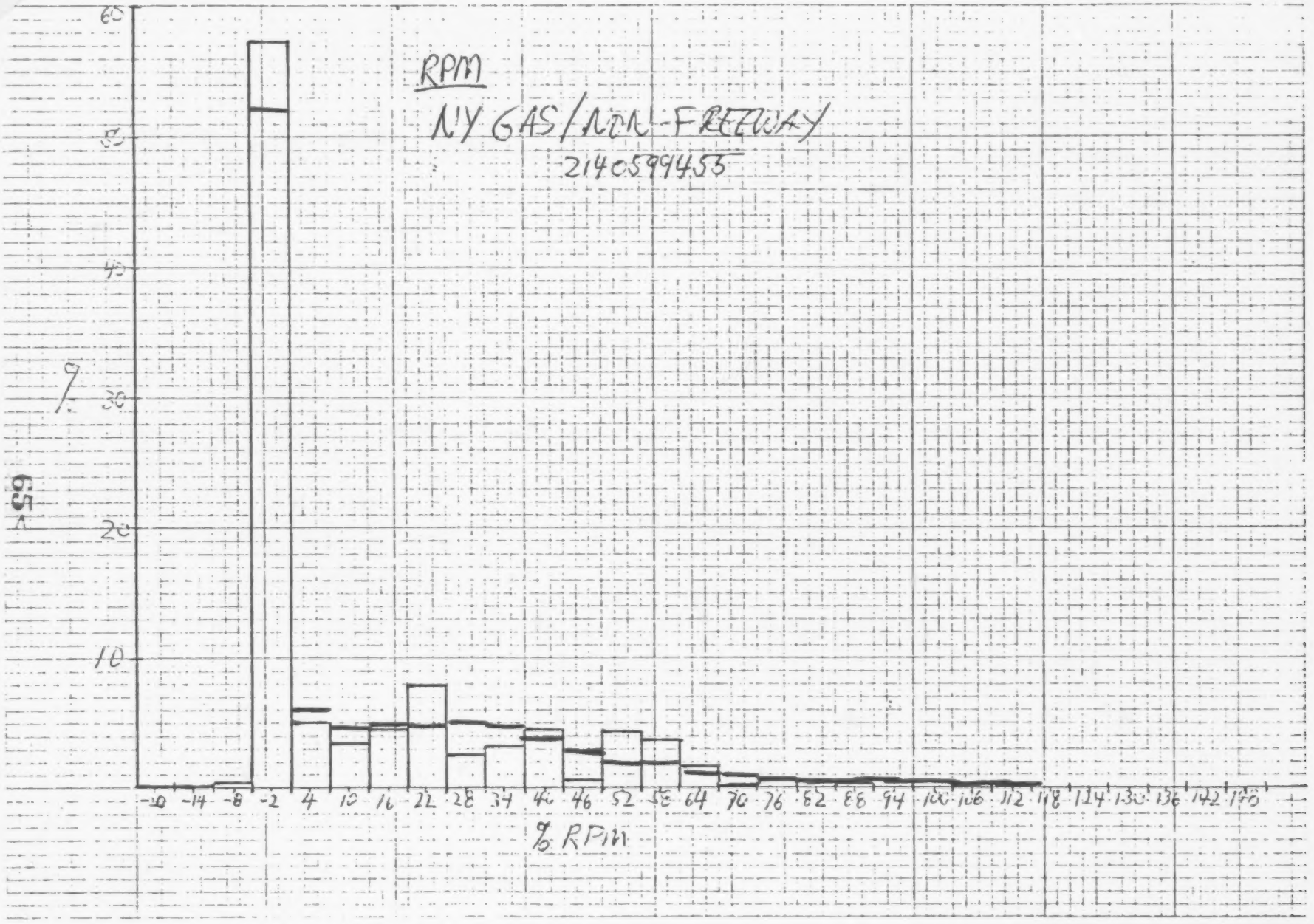

KM
LA DIESEL / FREEWAY
1091454501
60
50
40
30
20
10
% TA
-20 -14 -8 -2 4 10 16 22 28 34 40 46 52 58 64 70 76 82 88 94 100 106 112 118 124 130 136 142 148
% RPM

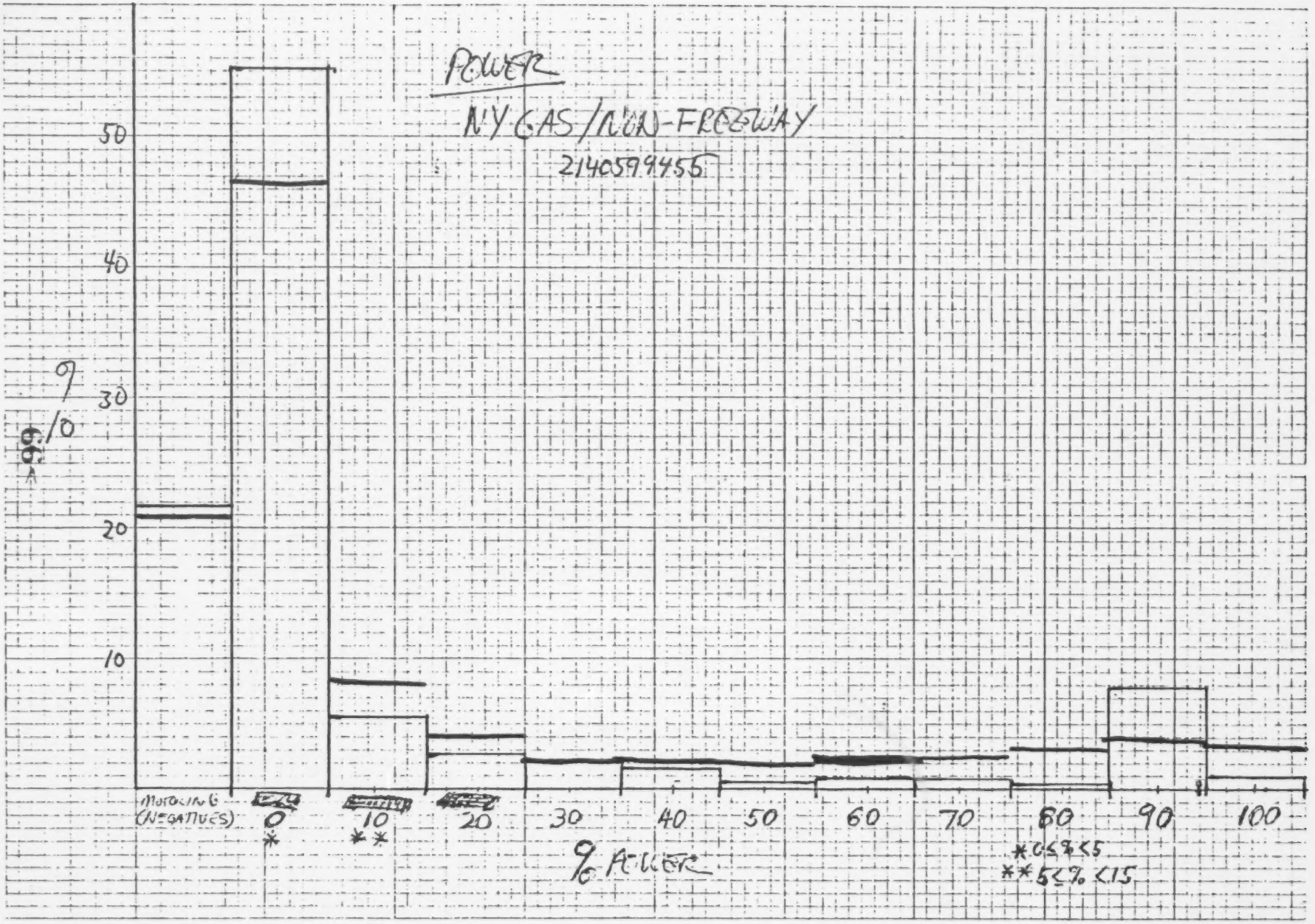

POWER
LA DIESEL/FREEWAY
1091454501
%
50
40
30
20
10
MOTORING (NEGATIVES)
0
10
20
30
40
50
60
70
80
90
100
*
**
% POWER
*0≤%<5
**5≤%<15

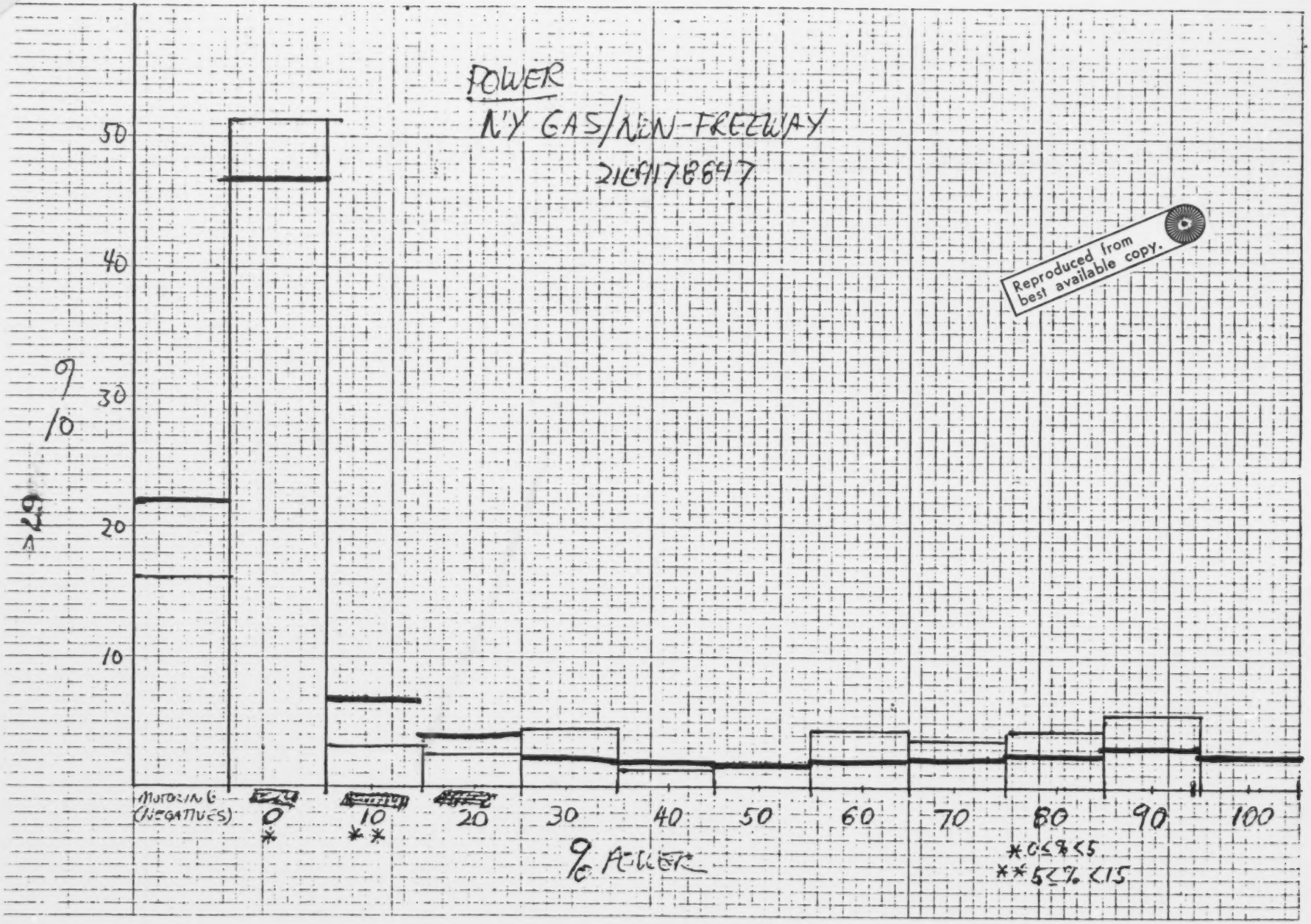
62


RPM
L4 DIESEL / FREEWAY
~~1519345415~~
1109958927
%
60
50
40
30
20
10
-20 -14 -8 -2 4 10 16 22 28 34 40 46 52 58 64 70 76 82 88 94 100 106 112 118 124 130 136 142 148
% RPM

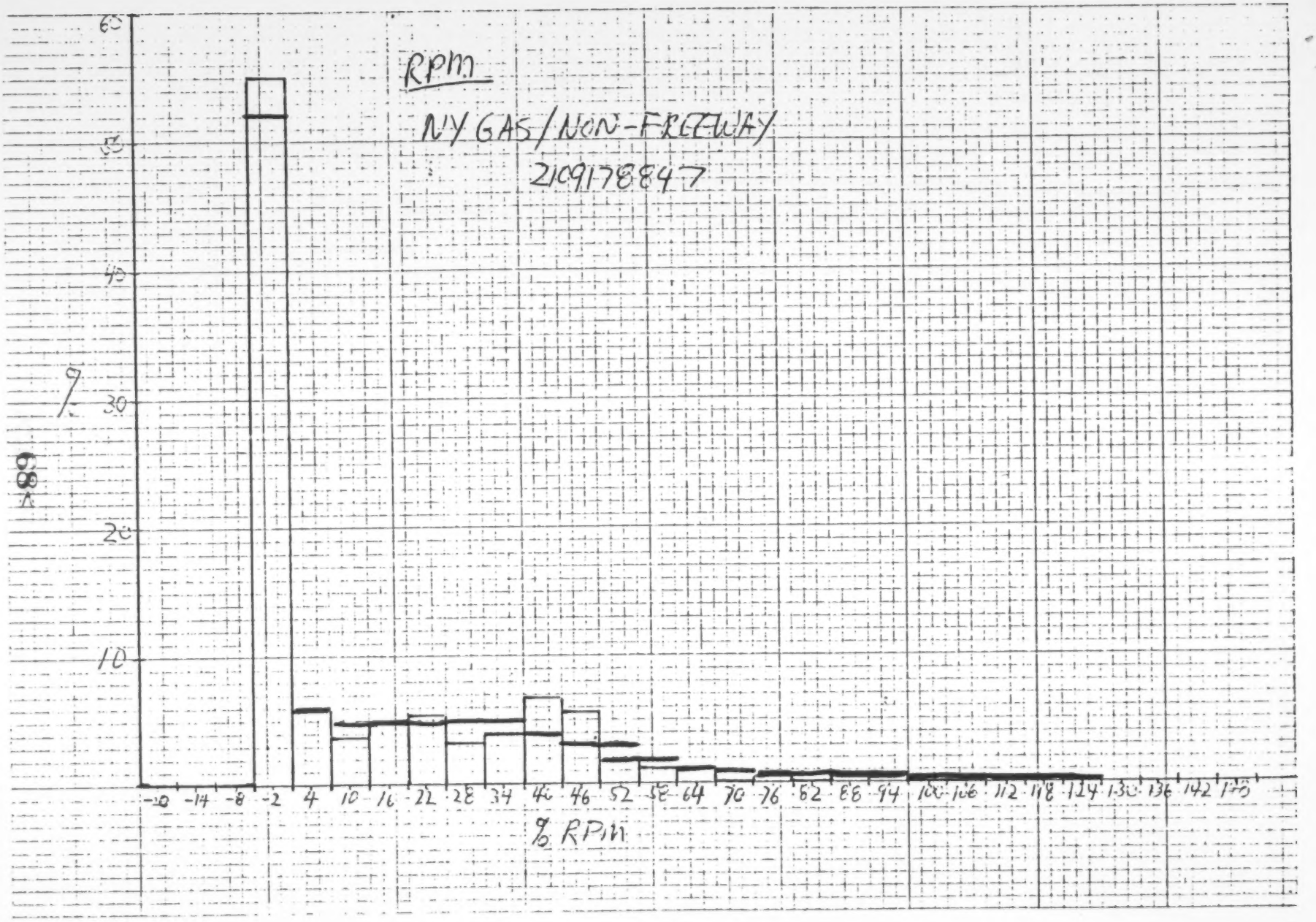

POWER
LA DIESEL / FREEWAY
1109958927
%
50
40
30
20
10
MOTORING (NEGATIVES)
0
*
10
**
20
30
40
50
60
70
80
90
100
% POWER
*0≤%<5
**5≤%<15

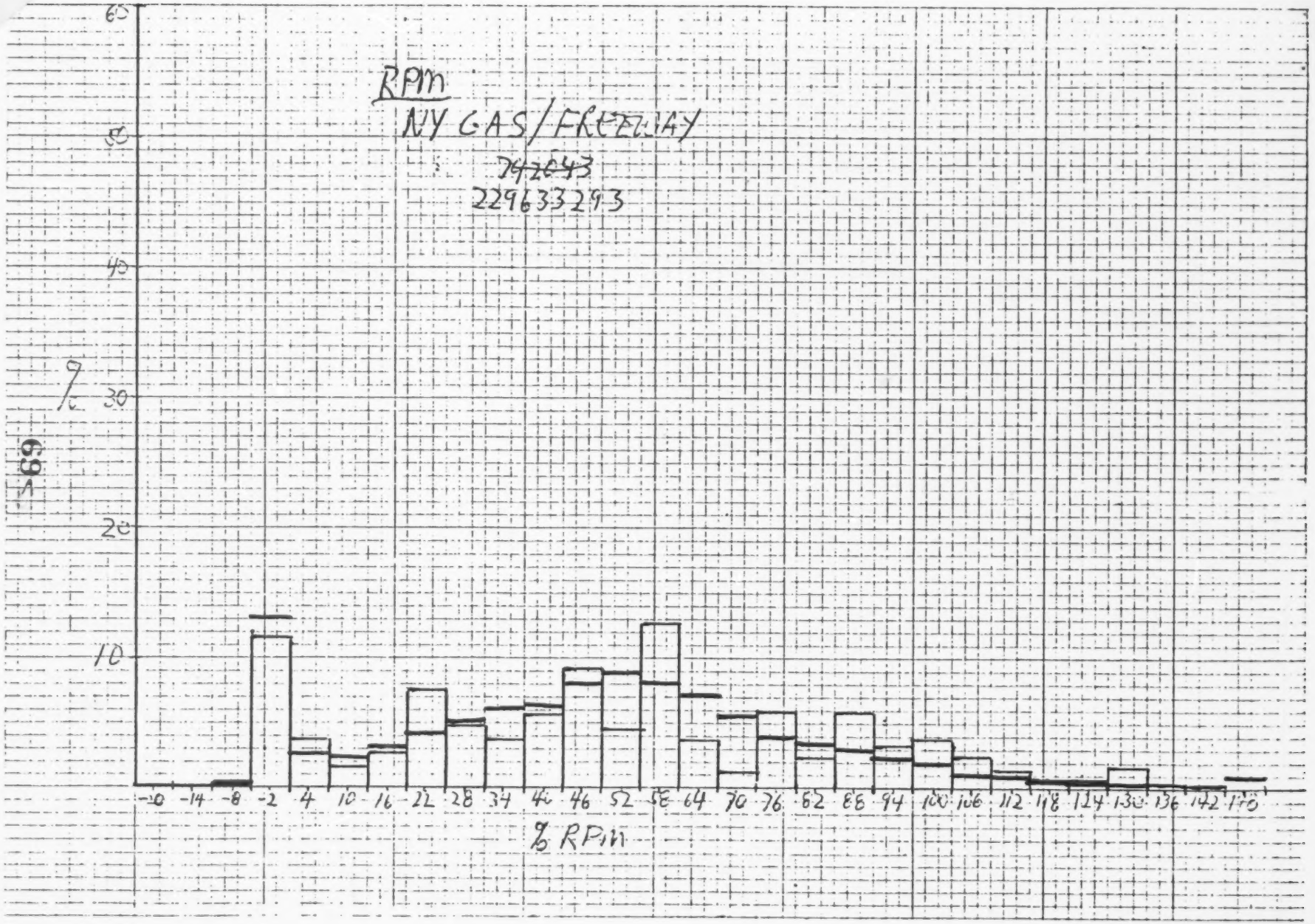

RPM
NY GAS/NON-FREEWAY
2140599455
60
50
40
30
20
10
%
GAS
-20 -14 -8 -2 4 10 16 22 28 34 40 46 52 58 64 70 76 82 88 94 100 106 112 118 124 130 136 142 148
% RPM

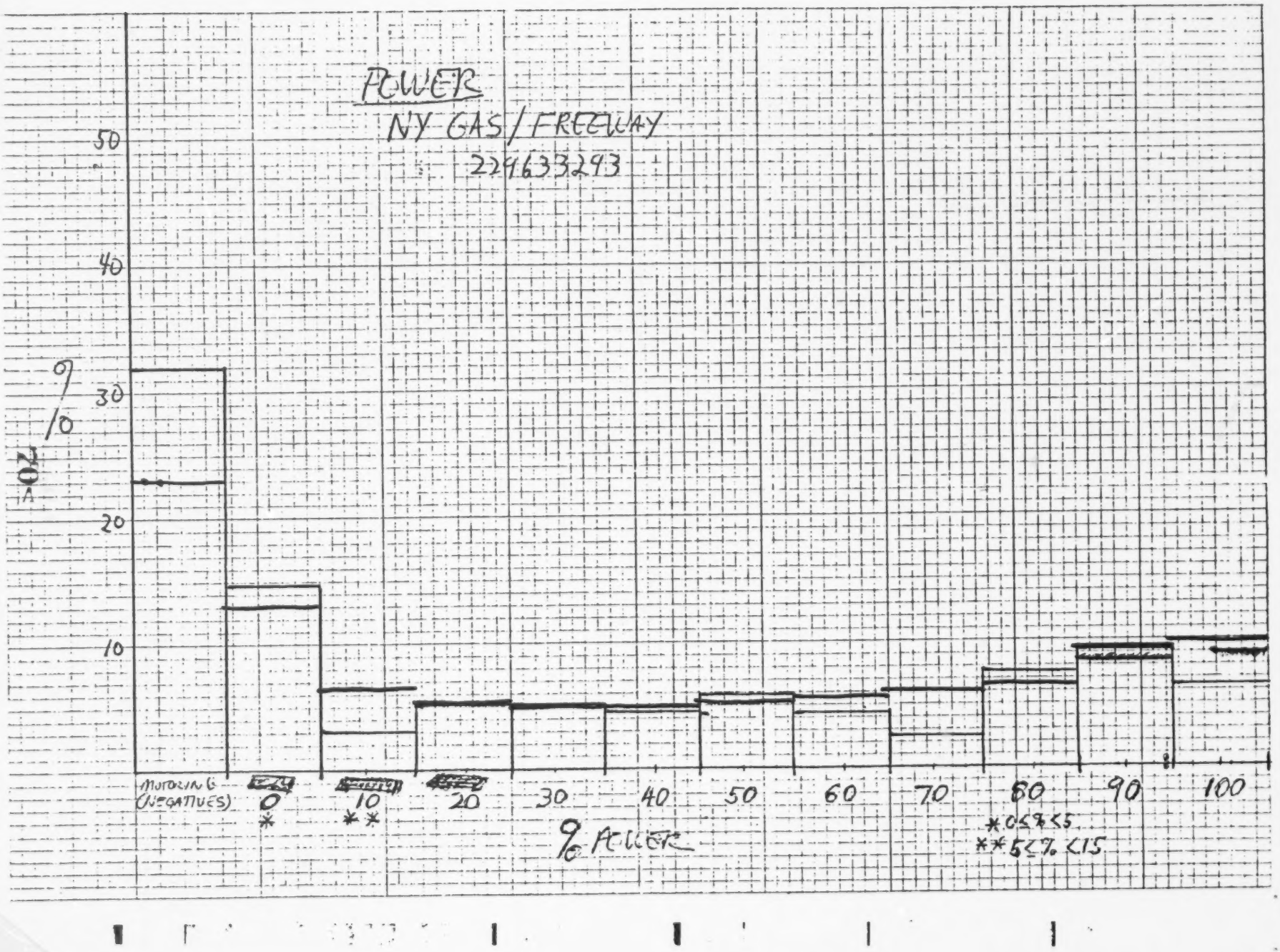

POWER
NY GAS / NON-FREEWAY
2140599455
50
40
30
20
10
9
6.10
MISSING (NEGATIVES)
0
10
20
30
40
50
60
70
80
90
100
% ACCEL
* 0 ≤ % < 5
** 5 ≤ % < 15

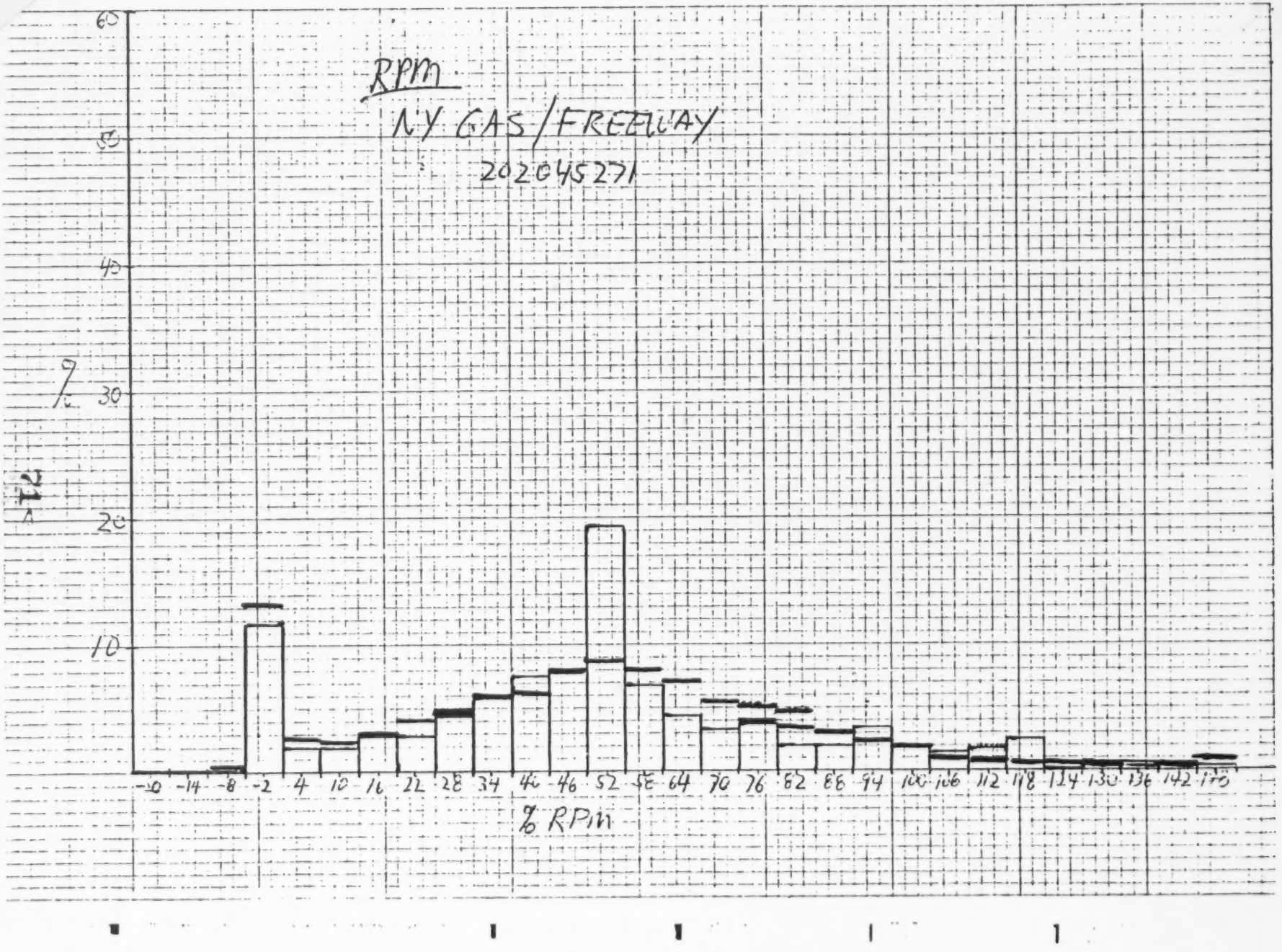


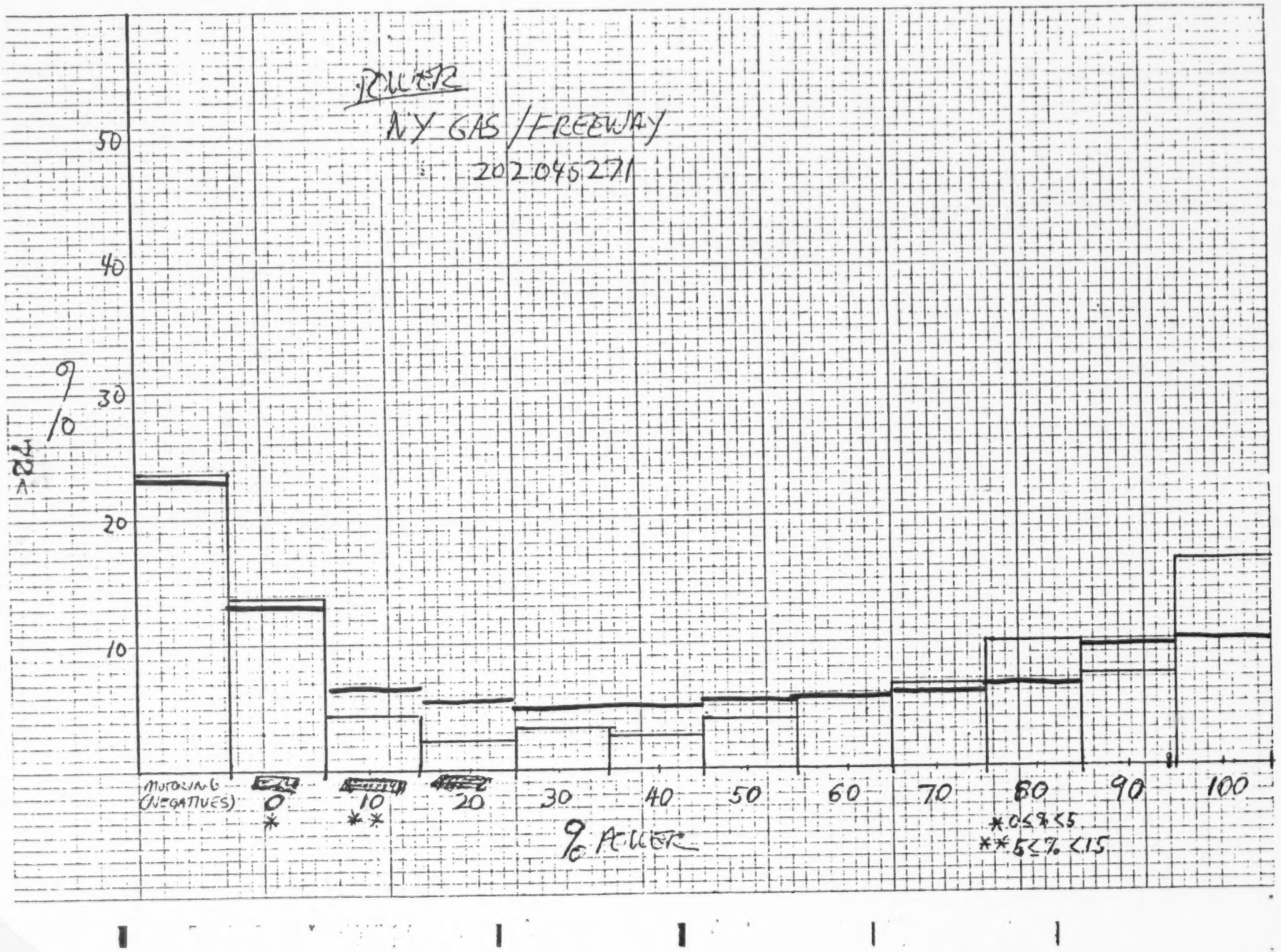
Reproduced from best available copy.


RPM
NY GAS / NON-FREEWAY
2109178847
60
50
40
30
20
10
%
-10 -14 -8 -2 4 10 16 22 28 34 40 46 52 58 64 70 76 82 88 94 100 106 112 118 124 130 136 142 148
% RPM

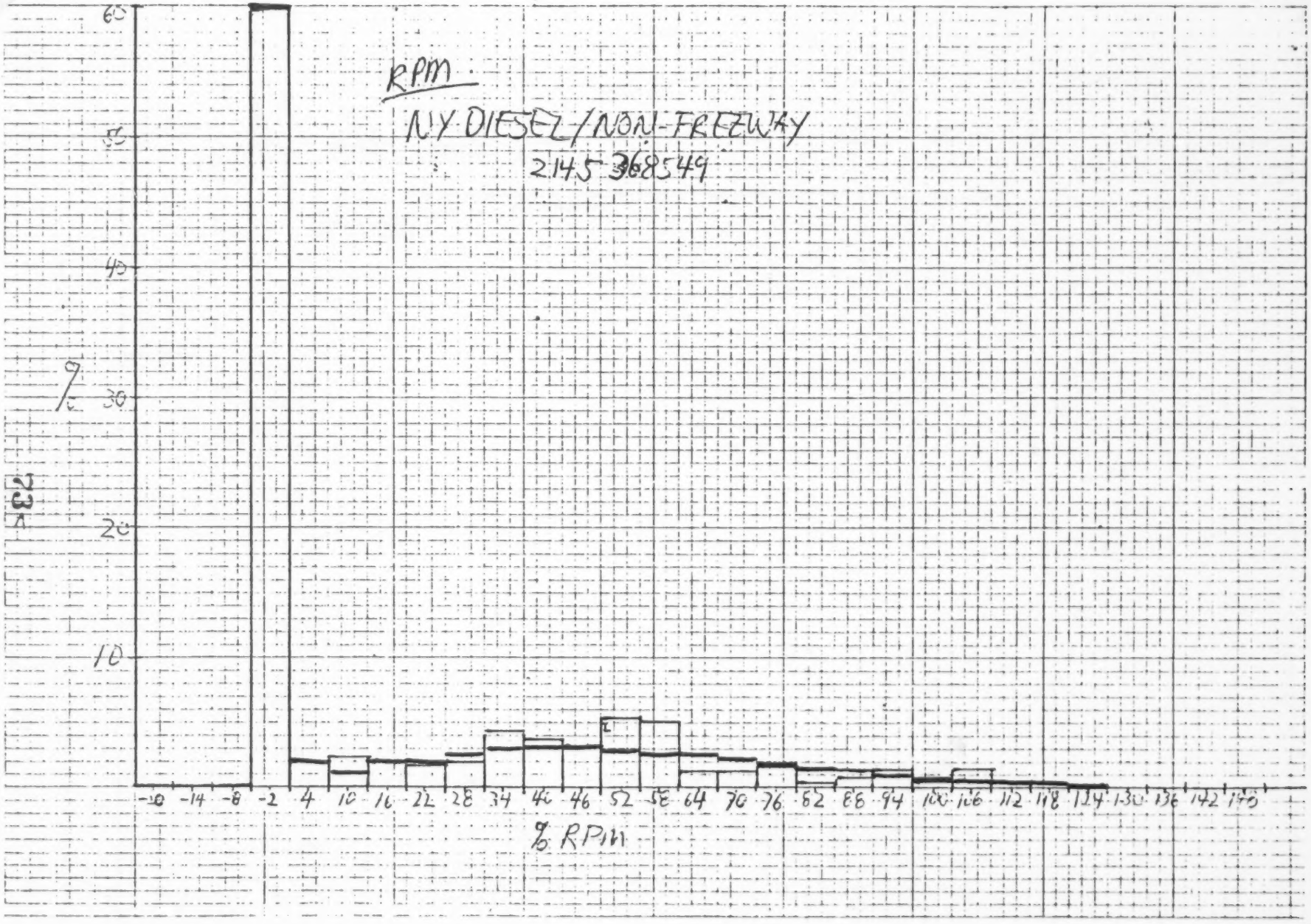

RPM
NY GAS/FREEWAY
~~742643~~
229633293
%
60
50
40
30
20
10
-20 -14 -8 -2 4 10 16 22 28 34 40 46 52 58 64 70 76 82 88 94 100 106 112 118 124 130 136 142 148
% RPM

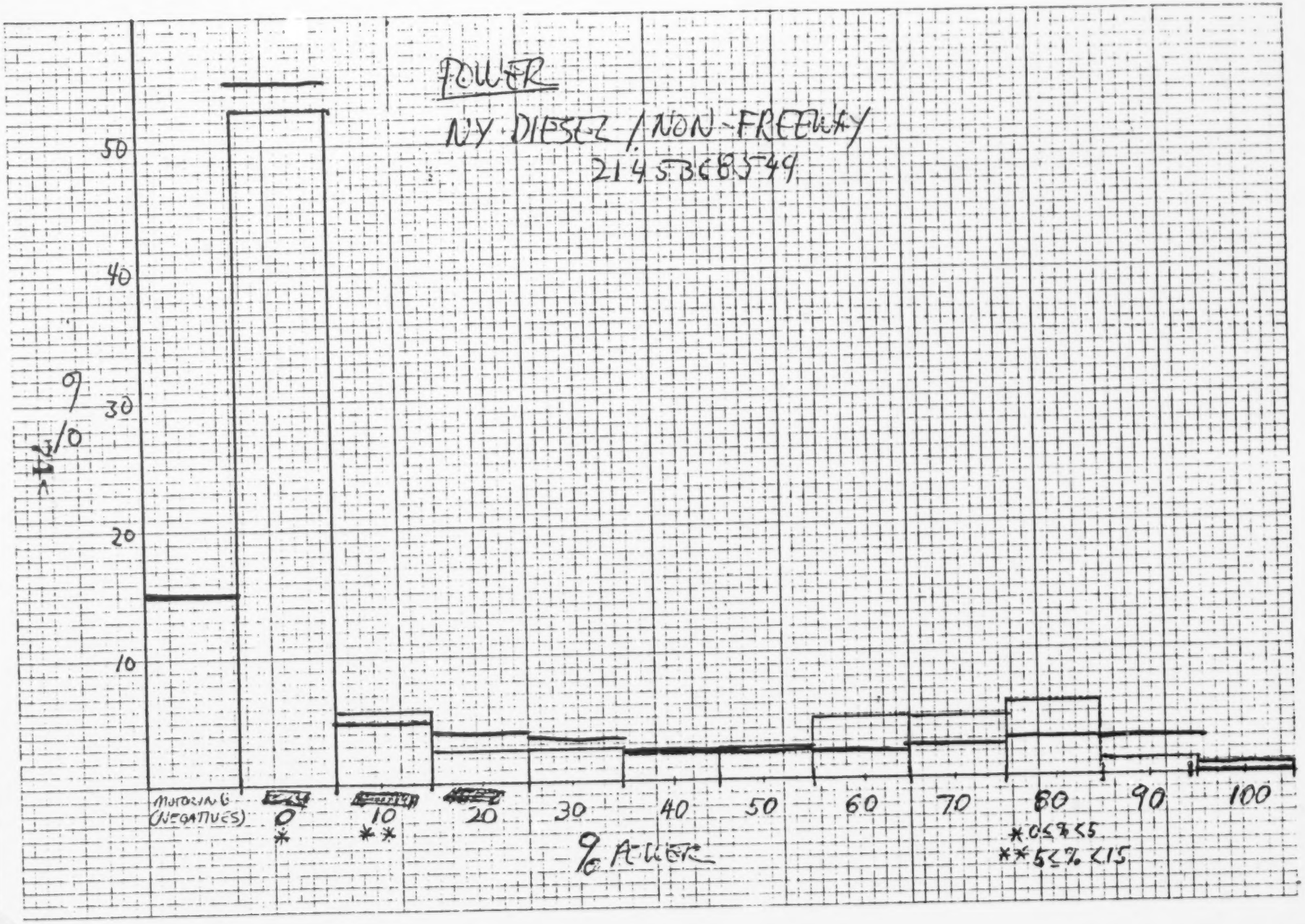

POWER
NY GAS/FREEWAY
229633293
%
50
40
30
20
10
MOTORING (NEGATIVES)
0
*
10
**
20
30
40
50
60
70
80
90
100
% POWER
*0≤%<5
**5≤%<15

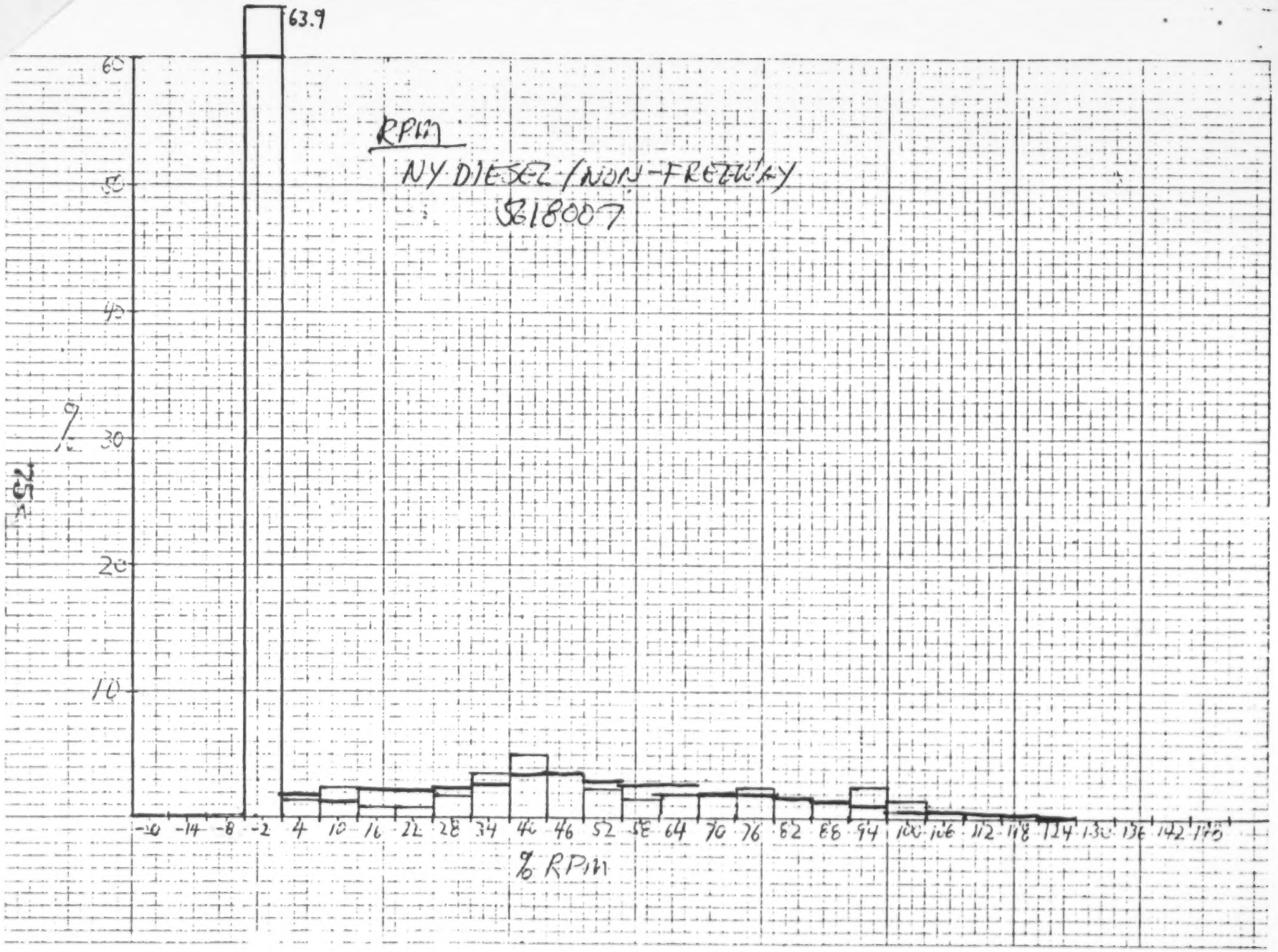

RPM
NY GAS/FREEWAY
202045271
60
50
40
30
20
10
%
-20 -14 -8 -2 4 10 16 22 28 34 40 46 52 58 64 70 76 82 88 94 100 106 112 118 124 130 136 142 148
% RPM

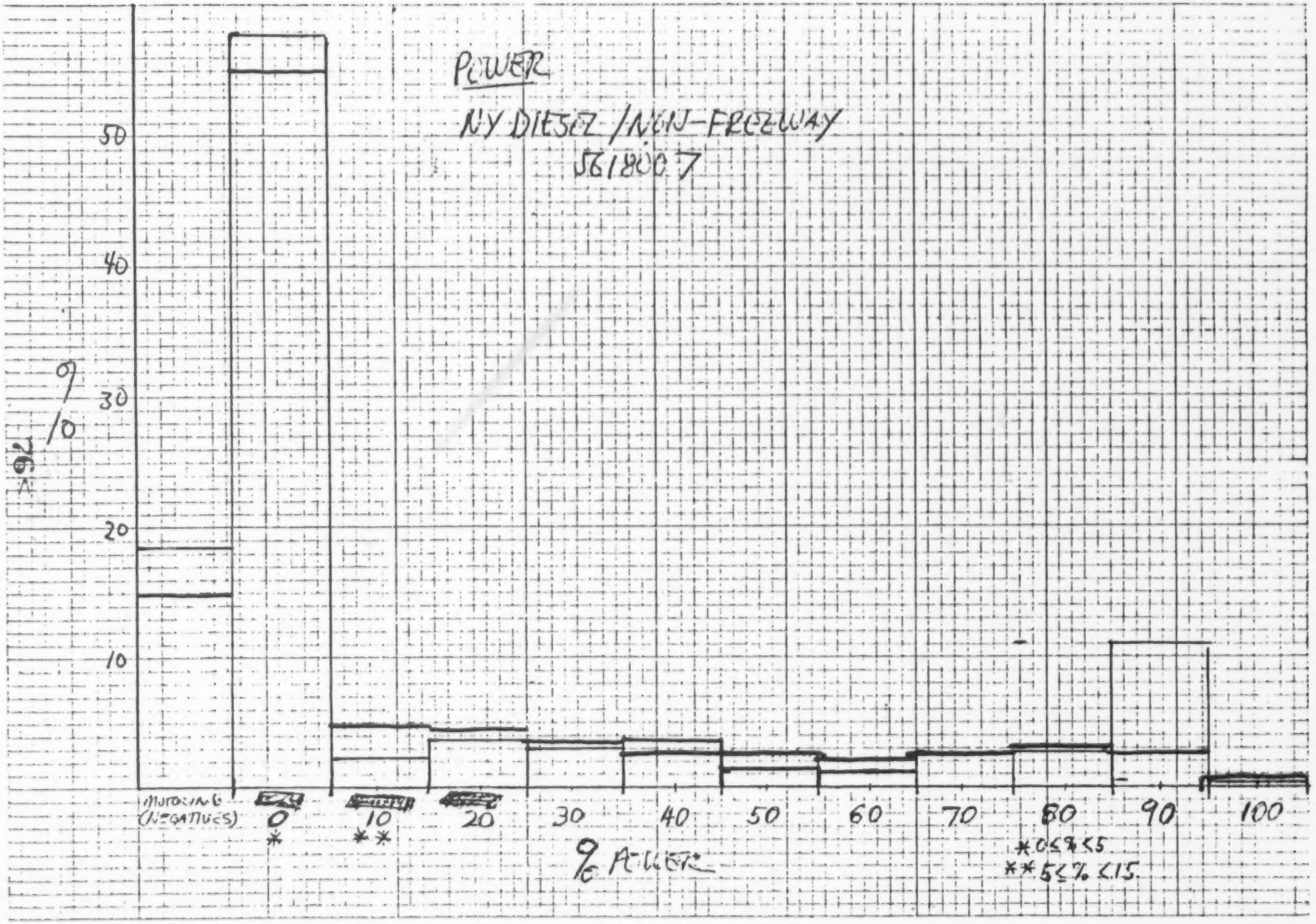

POWER
NY GAS / FREEWAY
202045271
%
50
40
30
20
10
MOTORING (NEGATIVES)
0
10
20
30
40
50
60
70
80
90
100
*
**
% POWER
*0≤%<5
**5≤%<15

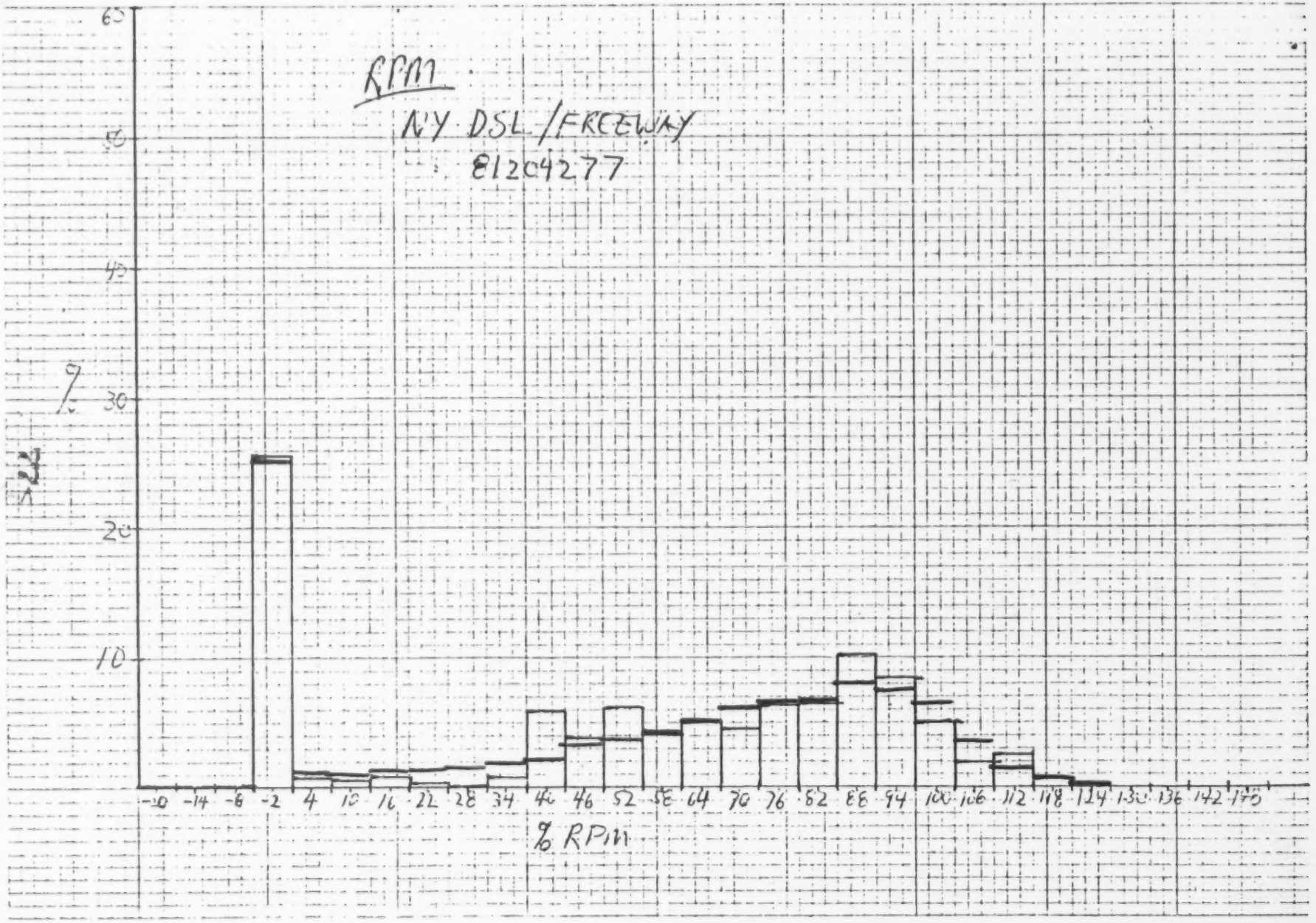
72

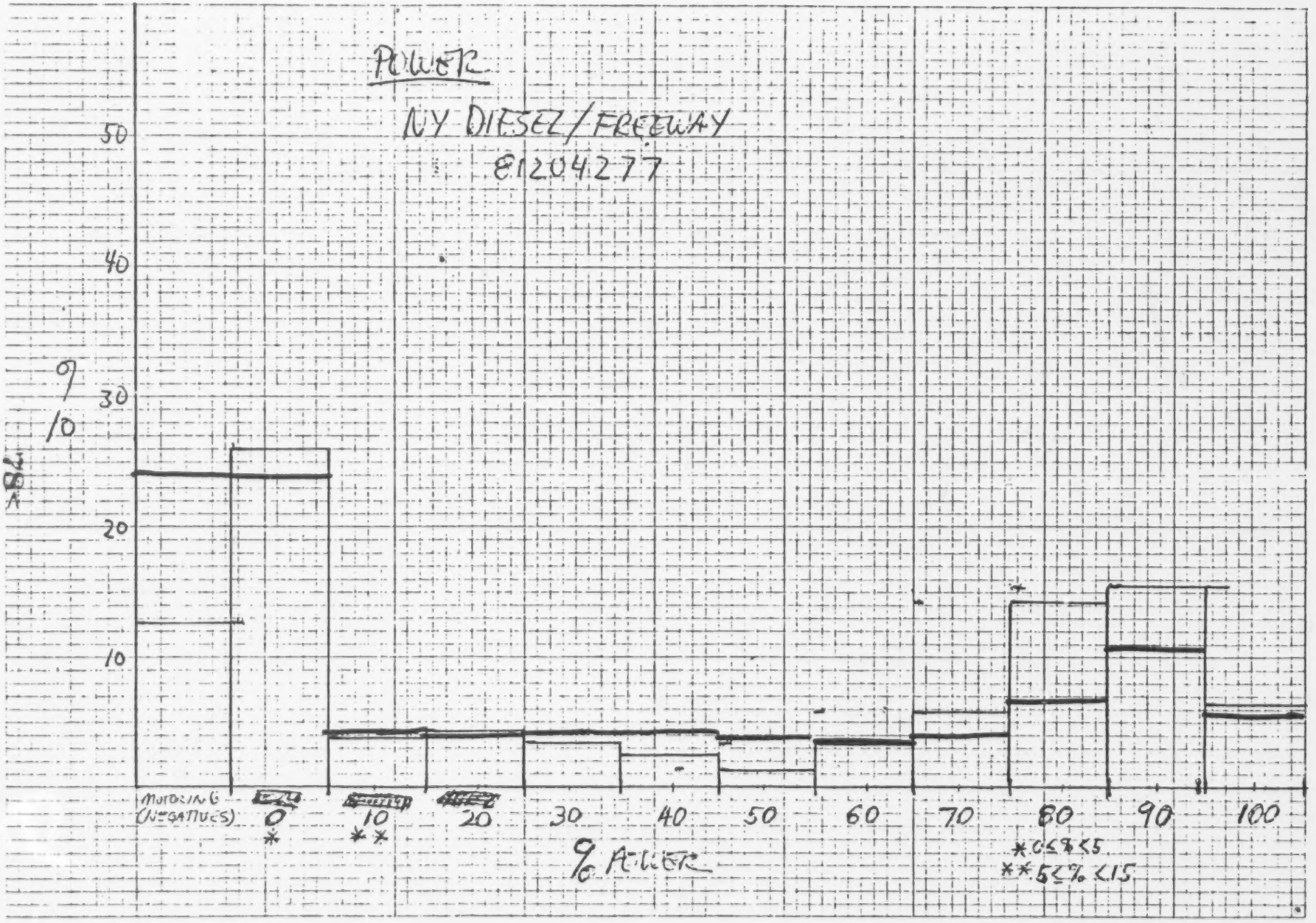

RPM
NY DIESEL / NON-FREEWAY
2145 368549
60
50
40
30
20
10
%
-10 -14 -8 -2 4 10 16 22 28 34 40 46 52 58 64 70 76 82 88 94 100 106 112 118 124 130 136 142 148
% RPM

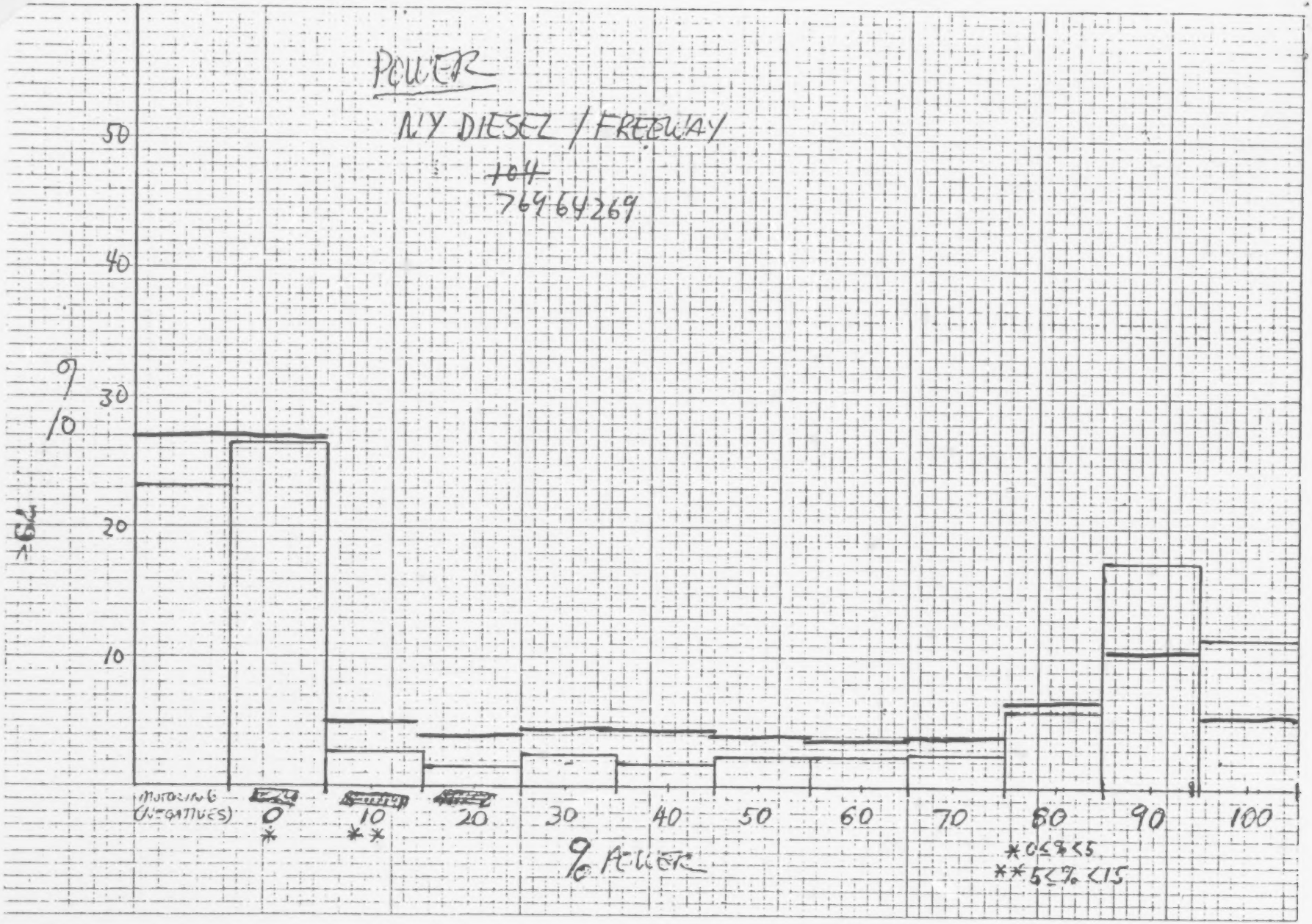

POWER
NY DIESEL / NON-FREEWAY
2145368549
%
50
40
30
20
10
MOTORING (NEGATIVES)
0
*
10
**
20
30
40
50
60
70
80
90
100
% POWER
*0≤%<5
**5≤%<15

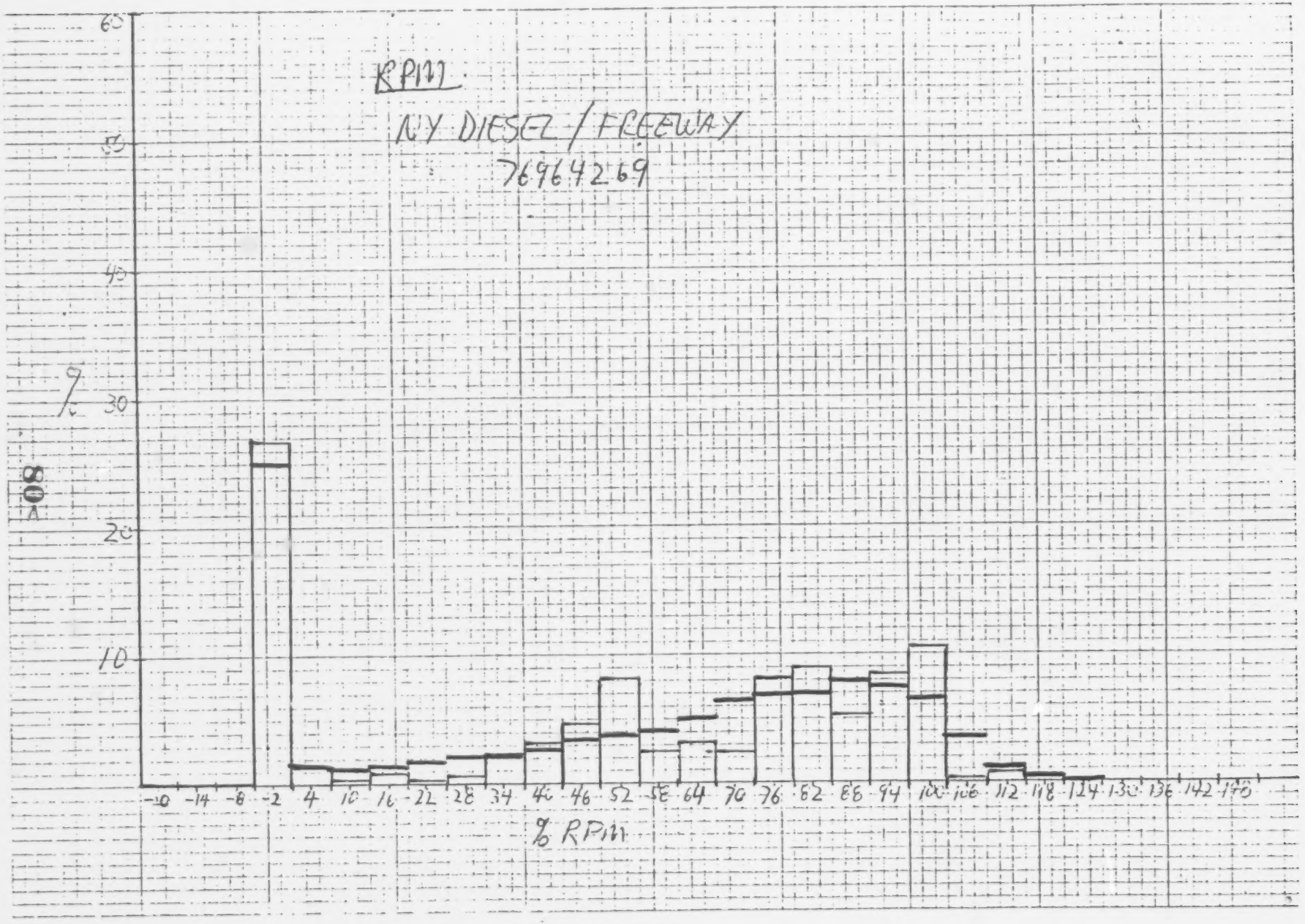

63.9
RPM
NY DIESEL / NON-FREEWAY
S18007
60
50
40
30
20
10
%
25
-20 -14 -8 -2 4 10 16 22 28 34 40 46 52 58 64 70 76 82 88 94 100 106 112 118 124 130 136 142 148
% RPM


POWER
NY DIESEL / NON-FREEWAY
5618007
%
50
40
30
20
10
MOTORING (NEGATIVES)
0
10
20
30
40
50
60
70
80
90
100
*
**
% POWER
*0≤%<5
**5≤%<15


RPM
NY DSL/FREEWAY
81204277
%
30
20
10
-10 -14 -6 -2 4 10 16 22 28 34 40 46 52 58 64 70 76 82 88 94 100 106 112 118 124 130 136 142 148
% RPM


POWER
NY DIESEL/FREEWAY
E1204277
50
40
30
20
10
g/10 A
MOTORING (NEGATIVES)
0
10
20
30
40
50
60
70
80
90
100
% POWER
*0≤%≤5
**5≤%≤15


POWER
NY DIESEL / FREEWAY
~~104~~
76964269
%
50
40
30
20
10
MOTORING (NEGATIVES)
0
*
10
**
20
30
40
50
60
70
80
90
100
% POWER
*0≤%<5
**5≤%<15


RPM
NY DIESEL / FREEWAY
7696426 9
60
50
40
30
20
10
% RPM
-10 -14 -8 -2 4 10 16 22 28 34 40 46 52 58 64 70 76 82 88 94 100 106 112 118 124 130 136 142 148

Addendum to
"Selection of Transient Cycles
for Heavy-Duty Engines"

November 1977

The preceeding basic report was originally intended to deal with only the statistical aspects of the transient engine cycles. No attempt was made to assess their physical or practical characteristics nor to justify the selections on the basis of these considerations. Assuming a valid data base, there is no reason to question the "drivability" of any candidate cycles.

Upon subsequent inspection, however, EPA has found that one category, N.Y. Gas Freeway, shows an unrealistic amount of high speed operation at abnormally high speeds (in the chosen cycle, #7920-, this amounted to some 26 seconds of sustained operation above 100% rated RPM, reaching a maximum of 150%). Since the candidate cycles for this category all matched the input to some extent, it appeared that the data base might be flawed. Indeed, when the CAPE-21 data for the New York trucks were reviewed, one truck was identified as having an inordinate amount of operation above 100% rated RPM, nearly 40% of its total operation. This single truck (number 09) also comprised a substantial portion (12.3%) of the NY gasoline freeway data. Something more than 83% of the total operation above 100% rated RPM in this category was contributed by this truck. Also, this truck accounted for nearly 100% of the operation above 116% rated RPM.

The offending truck appears to have exhibited the excessive speeds because of an error in the RPM normalization process. The absolute RPM values originally recorded may have easily been reasonable; but the large number of normalized values (see footnote p. 7 of the report) in excess of 100% indicate that the rated RPM was misidentified for this particular truck. In any case, the RPM data for the truck is tainted and its presence in the input can be expected to have had some undesirable effects.

As a remedy to the situation, EPA has decided to delete from cycle 7920-the portion which exceeds a percent RPM value of 100, i.e., the cycle will merely be shortened by the 26 seconds of "overspeed" operation (see attachment). The effects which this action will necessarily have on the cycle are addressed below.

Expressed concisely, the presence of data from truck 09 compromises the representativeness of any cycle generated from the NY Gas Freeway data base. On the other hand, it cannot be assumed that the correlation to the road data has been lost. What is known is that in the higher speed range (over 116% RPM), all of the operation is due to Truck 09, and nothing is compromised by taking this operation out. Also along these lines, the corresponding power values in the deleted segment were derived as well from the Truck 09 data (by virtue of the cycle generation procedure).

However, Truck 09 also understandably exhibited operation in the sub-100% RPM range, and the percent RPM values here too will be unreasonably high. This effect is of somewhat less magnitude than that in the high ranges (where Truck 09 is 100% of the data), but to what extent the 8% of the data which Truck 09 represents in the lower ranges affects

this cycle in unclear. Also, because of the removal of power as well as RPM values from the cycle, the power density function will be somewhat altered (although this change is not radical).

Finally, EPA has done no statistical testing of the quality of the modified cycle; actually, such a check is meaningless because the input with which the cycle would be compared is itself no longer valid. The matrix from which the cycles were generated will change if Truck 09 is deleted, but the complexity of the matrix would make any determination of how it is altered an enormous task of questionable value.

The revised cycle does compromise the representativeness of this category's road data; despite this, it is felt that at the very least the cycle is certainly more representative than the original version. The range of speed is more reasonable, and when its limitations are recognized, the cycle is an adequate substitute.

Truck 09 also had some non-freeway operation comprising 6.9% of the total NY Gas Non-Freeway data. Hence, the quality of the cycle chosen for this category, #841-, is diminished somewhat. It is felt, however, that the contribution of truck 09 to the non-freeway data is not sufficient to require modification or replacement of cycle 841-, and it remains as it appears in the main report.

CYCLE # 7920435 35

New York - All Gasoline

FREEWAY

SECOND	% RPM	% POWER
0.	0.0	0.0
1.	0.0	0.0
2.	0.0	0.0
3.	0.0	0.0
4.	0.0	0.0
5.	0.0	0.0
6.	0.0	0.0
7.	0.0	0.0
8.	0.0	0.0
9.	0.0	0.0
10.	0.0	0.0
11.	0.0	0.0
12.	0.0	0.0
13.	0.0	0.0
14.	0.0	0.0
15.	1.44	0.0
16.	8.15	10.37
17.	14.70	20.00
18.	21.00	20.00
19.	21.98	10.09
20.	26.10	4.81
21.	29.93	90.00
22.	35.65	90.00
23.	39.24	90.00
24.	40.00	92.22
25.	40.00	80.00
26.	40.14	90.00
27.	43.00	80.00
28.	42.91	86.00
29.	44.00	63.06
30.	44.00	71.66
31.	44.00	80.00
32.	44.00	90.00
33.	43.61	86.12
34.	42.00	70.00
35.	42.00	50.82
36.	42.00	43.14
37.	43.65	31.76
38.	44.00	33.81
39.	44.00	40.00
40.	44.59	45.92
41.	46.00	46.40
42.	46.00	36.11
43.	46.00	47.68
44.	46.00	50.00
45.	48.00	49.17
46.	49.00	35.19
47.	48.00	20.00
48.	49.11	36.65
49.	50.00	57.12
50.	50.00	60.00
51.	50.00	60.00
52.	50.00	60.00
53.	50.00	49.74
54.	50.00	30.00
55.	50.00	23.43
56.	50.00	20.00
57.	50.00	0.57
58.	50.00	MOTORING
59.	50.00	62.86
60.	50.00	65.56
61.	50.00	47.98
62.	53.03	40.00
63.	54.00	21.61
64.	54.15	21.47
65.	56.00	42.31
66.	56.00	46.12
67.	56.00	50.91
68.	56.00	52.97
69.	56.00	41.40
70.	58.00	20.53
71.	58.00	50.00
72.	58.00	46.67
73.	58.00	44.90
74.	58.00	43.53
75.	58.00	40.00
76.	58.00	40.00
77.	60.24	40.00
78.	61.85	40.00
79.	60.00	44.34
80.	58.82	14.50
81.	56.50	MOTORING
82.	57.81	MOTORING
83.	58.00	MOTORING
84.	57.11	MOTORING
85.	54.00	MOTORING
86.	52.93	6.09
87.	52.00	33.87
88.	53.70	65.53
89.	56.00	60.00
90.	56.00	60.00
91.	56.00	47.09
92.	56.00	20.00
93.	57.28	32.76
94.	58.00	40.00
95.	58.00	40.00
96.	60.22	80.00
97.	63.07	77.33
98.	66.00	70.00
99.	67.16	75.82
100.	66.52	87.40
101.	66.00	98.97
102.	67.89	100.00
103.	66.00	100.00
104.	66.00	100.00
105.	66.00	100.00
106.	66.00	100.00
107.	67.68	91.59
108.	68.00	90.00
109.	70.00	80.00
110.	70.00	76.86
111.	70.00	72.00
112.	70.00	70.00
113.	70.00	77.86
114.	71.89	79.57
115.	72.00	67.99
116.	72.00	57.74
117.	72.00	67.54
118.	70.85	15.64
119.	68.54	MOTORING
120.	68.00	MOTORING
121.	67.91	MOTORING
122.	66.00	MOTORING
123.	65.28	11.58
124.	64.00	44.83
125.	64.00	25.51
126.	64.00	11.69
127.	64.00	0.11
128.	62.88	MOTORING
129.	68.00	46.95
130.	69.85	35.39
131.	73.24	30.00
132.	74.00	30.00
133.	75.87	49.67
134.	78.19	50.91
135.	80.00	42.61
136.	79.19	2.17
137.	78.00	31.26
138.	80.88	25.59
139.	82.22	28.78
140.	122.22	39.65
141.	122.17	39.64
142.	124.00	75.50
143.	124.00	70.00
144.	124.00	70.00
145.	128.93	70.00
146.	145.68	70.00
147.	146.53	63.14
148.	150.00	22.95
149.	150.00	30.00
150.	150.00	30.00
151.	130.07	-999.99
152.	120.30	-999.99
153.	120.00	-999.99
154.	121.91	80.00
155.	130.38	80.00
156.	135.11	85.54
157.	138.84	90.00
158.	140.00	90.00
159.	139.95	87.67
160.	137.27	-999.99
161.	131.96	-999.99
162.	128.00	-999.99
163.	126.69	-999.99
164.	124.37	71.29
165.	125.94	99.70
166.	82.00	91.28
167.	82.57	100.00
168.	86.65	100.00
169.	90.00	100.00
170.	90.00	100.00
171.	93.66	100.00
172.	94.00	92.08
173.	94.00	-999.99
174.	94.77	-999.99
175.	96.00	-999.99
176.	94.60	-999.99
177.	92.28	-999.99
178.	91.57	-999.99
179.	66.00	70.00
180.	64.68	70.00
191.	62.98	50.46
182.	64.00	23.54
183.	64.00	-999.99
184.	62.08	-999.99
185.	33.05	-999.99
186.	25.45	-999.99
187.	20.54	-999.99
188.	12.46	-999.99
189.	7.01	-999.99
190.	2.38	-999.99
191.	2.00	0.0
192.	2.44	15.39
193.	4.75	70.00
194.	15.62	70.00
195.	24.00	63.08
196.	25.70	60.00
197.	26.00	59.93
198.	26.00	54.93
199.	26.00	70.35